

# Renewing Research on Problemistic Search – A Review and Research Agenda

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**ABSTRACT**

Problemistic search theory, with its roots in the Carnegie School tradition, describes a behaviorally plausible process by which firms learn from performance feedback. A firm's recognition of performance below aspirations leads to search for a solution to the problem, resulting in change intended to restore performance to the aspired level. The concept of problemistic search has diffused broadly in the management literature — it is a central theoretical concept in a broad variety of organizational theories, and an important explanation of a wide variety of organizational behaviors and outcomes. We review the literature and argue that the development of the theory has not kept pace with the breadth of the unfolding literature. We identify six critical issues with extant research that can be traced back to a continued (over) reliance on the initial conceptualization of problemistic search. To address these issues and to revitalize research, we propose a research agenda premised on a more central role for cognition in the theory and the need for greater emphasis on a process perspective of problemistic search.

## 1. INTRODUCTION

Problemistic search theory, with its roots in the work of Herbert Simon, Richard Cyert, and James March, describes a behaviorally plausible process by which firms learn from performance feedback. A firm's recognition of performance below aspirations, which is the level of future performance deemed acceptable, leads to a process of search to discover a solution to the problem, resulting in behavioral change intended to restore performance to the aspired level. Consider, for example, sales at a large national retailer that fail to meet the firm's aspiration. Consequently, the firm engages in search by sequentially testing alternatives to current sales activities, e.g., increasing advertising, redecorating stores, or expanding online presence. If increasing advertising is successful, returning sales to the desired level, then search ceases and the firm continues advertising at the new level. In this paper, we review extant research on problemistic search, identify gaps and shortcomings, and develop a research agenda to address these gaps.

While the concept of problemistic search has diffused broadly in the management literature over the past half-century, development of the theory underlying the concept has not kept pace with the breadth of the unfolding literature. Problemistic search is a central theoretical concept in a broad variety of organizational theories, and an important explanation of a wide variety of organizational behaviors and outcomes, including, for example, strategic change and reorientation, risk taking, organizational adaptation, knowledge generation, organizational learning, new resource creation, and innovation. Most studies that use the theoretical apparatus of problemistic search match quite closely to its early conception in Cyert and March's (1963) seminal work, "*A Behavioral Theory of the Firm*," and prior developments in March and Simon (1958). The refinements and challenges to the conceptualization that have arisen from research on

problemistic search, as well as from adjacent streams of work, have not been sufficiently integrated into the conceptualization of problemistic search. Given this lack of integration, our theoretical understanding of problemistic search remains incomplete and empirical progress has been held back.

We take stock of the large literature on problemistic search via a review using a process oriented perspective. We identified an initial sample of 2440 papers that invoke problemistic search. Our primary sample in our main analysis focuses on a subset of 233 papers, which form the backbone of the literature. While the claim that performance below an aspiration leads to change has become taken-for-granted, our review of the empirical literature suggests surprisingly mixed results.

We identify six critical issues with current research that have hindered theoretical and empirical progress. First, problemistic search is conceptualized as overly routinized, assuming a high degree of automaticity in managerial decision-making, with a limited role for cognition. Second, problemistic search theory focuses attention on the search for solutions to a given problem, overlooking behaviors oriented towards identifying the latent problem underlying a performance shortfall. Third, empirical research tends to conjoin distinct elements of problemistic search (e.g., triggering search, searching, change). In particular, due to data constraints, empirical research rarely examines search among potential solutions, blackboxing this element of the process and focusing on how performance below the aspiration triggers change as an outcome that restores performance. Fourth, in the theory, performance below aspiration is generally viewed as a driver of exploitation of known solutions to existing problems, even though extant theory has begun to point to the importance of exploratory activities such as R&D and risk taking. Fifth, the key prediction of problemistic search, that performance below aspiration leads to change (e.g.,

new routines, practices, policies) conflicts with alternative theories that predict stasis or even reinforced behavior (e.g., threat rigidity and escalation of commitment). Finally, problemistic search theory focuses on a narrowly delineated outcome, change that restores performance above the aspiration. Yet a diverse array of research and anecdotal evidence suggests that search processes have unintended outputs which, while they may have little bearing on the focal problem, may be organizationally important and valuable.

Our review suggests that these issues can be traced to a continued (over) reliance on the initial conceptualization of problemistic search and a research approach that focuses on variance theorizing. Cyert and March's (1963) conceptualization reflects their objective of providing a theoretical counterpoint to neoclassical economic theories of that era, which assumed unrealistically rational economic actors. Their conceptualization was thus constrained to a purposefully simple and highly mechanistic formulation of organizational action. The research agenda we propose is premised on a revised conceptualization of problemistic search that makes two important shifts.

First, and foremost, we believe that advancement of the literature must be premised on a more central role for *cognition* than suggested by the traditional conceptualization of the theory. While cognition plays only a limited role in Cyert and March's (1963) formal discussion of problemistic search, March and Simon (1958) recognize the importance of cognition in organizational decision-making processes, and March and Olsen (1976) highlight the role of individuals' beliefs. A cognitive perspective assumes that behaviors are premised on beliefs, a mental model, describing the relationship between alternative actions and outcomes. It shifts attention to organizational information processing and shared mental representations that may shape organizational processes such as problemistic search. It has historically been

under-theorized in the literature on problemistic search. Nonetheless, other research streams, also in the Carnegie School tradition, have made important strides by adding back a modicum of cognition to behavioral theory. The time has come for research on problemistic search to do the same.

Second, we believe substantial theoretical and empirical progress could be made by taking a *process approach* to problemistic search. Much of the extant research employs a variance theory approach. It tends to treat problemistic search as a black box, examining the correlation between a performance shortfall that triggers the process and the changed outcome that restores performance, concluding the process. A process perspective focuses attention on how the behaviors associated with problemistic search unfold over time, forcing scholars to open up the black box and illuminate the stages of the problemistic search process. To this end, we suggest a revised process architecture characterized by two distinct search stages. While the literature currently pays attention to solution search, we believe that this stage is sometimes preceded by problem definition search. Problem definition search is the process of diagnosing the cause of the performance shortfall. It likely requires a meaningful degree of cognitive input by managers, and thus demands a theoretical formulation underpinned by cognition. Moreover, the outcome of problem definition search may act as a mental representation that guides subsequent search for solutions that resolve the problem.

By examining problemistic search from a process theory perspective and by adding back a modicum of cognition to the theory, we raise the possibility of a renewed and substantive research program on problemistic search as a centrally important, commonly observed organizational activity. Such a program may lead to a richer understanding of the functioning of problemistic search and facilitate distinguishing problemistic search from other search processes, such as slack

search or institutionalized search, which may co-occur but are expected to differ in their characteristics. It may also shed light on how problemistic search may function as a “master switch” to engender a broad range of behaviors (Greve, 2003c), both exploitative and exploratory; doing so points to a multitude of ancillary outputs of problemistic search that may create value for the organization.

Our paper is structured as follows. In the next section we review the extant research on problemistic search. We take a process approach, summarizing both theoretical developments and empirical tests in extant research in which problemistic search is a key theoretical mechanism. We use the literature review to identify critical gaps in our understanding of problemistic search. Building on this review and assessment, we highlight key elements of a research agenda that addresses these gaps.

## **2. EXTANT RESEARCH ON PROBLEMISTIC SEARCH**

Following the publication of *A Behavioral Theory of the Firm* (Cyert & March, 1963), the concept of problemistic search has been widely adopted and diffused. In this section, we provide an in-depth review of the literature on problemistic search, summarizing theoretical developments and empirical tests. We begin by briefly highlighting its original conceptualization, then outline the methodology used to choose papers for inclusion in this review. Finally, we explicate the results of the review.

To facilitate our discussion, we divide the literature into four broad areas of focus that follow an analytical process model of problemistic search as depicted in Figure 1: (a) triggers of problemistic search, (b) characteristics of solution search, (c) behavioral consequences that are the outcomes of problemistic search, and (d) stopping mechanisms of problemistic search. The

process model depicted in the figure represents a linear simplification of the model described by Cyert and March (1963). In practice, stages of the model may be further connected through feedback loops, and organizations may cycle back and forth between stages.

<< Insert Figure 1 here >>

## **2.1. Original Conceptualization**

The formal conceptualization of problemistic search in March and Simon (1958) and Cyert and March (1963) is built on the idea that organizational decision-making cannot be described by the selection of the optimal course of action among a set of known alternatives. Rather, for boundedly rational decision-makers and organizations, it is a process of search to identify alternative actions. Search stops when the decision-maker encounters the first alternative that provides satisfactory performance (Simon, 1947, 1955, 1956). Problemistic search can be understood as the specific case where search for alternatives is triggered when the organization encounters a problem and ceases when a satisfactory solution is identified (Cyert & March, 1963; March & Simon, 1958; Simon, 1955). Cyert and March (1963: 121) argue that this process is central to organizational decision-making. Organizations “make decisions by solving a series of problems; each problem is solved as it arises; the organization then waits for another problem to appear. Where decisions within the firm do not naturally fall into such a sequence, they are modified so that they will.”

Problemistic search is a simple process of learning from performance feedback. The theory assumes that organizations and its decision makers possess aspirations that define the acceptable level of performance (Cyert & March, 1963; Frank, 1935; March & Simon, 1958). Problemistic search is triggered by a performance shortfall relative to that aspiration. Via search,



the firm seeks to identify and to learn about the merits of alternative solutions. The firm sequentially engages in change to the organization's practices (routines, products, markets, technologies, etc.) over time, sampling alternative changes that may attenuate the performance shortfall. Search terminates when an alternative that restores performance above the aspiration is identified and implemented.

The original conceptualization of problemistic search was constructed with simplicity in mind. In its historical context, the simplicity of problemistic search was a reaction to behavioral assumptions in neoclassical economics, which scholars in the Carnegie School viewed as unrealistic representations of the cognitive abilities of individuals and organizations (March & Simon, 1958; Simon, 1947). This simplicity was reflected across three key features of problemistic search. First, organizations employ a simple mapping between a performance shortfall relative to an aspiration and a problem, allowing the organization to move directly from the recognition of a performance shortfall to solution search. A key insight in Cyert and March (1963), in this respect, was that an organization requires a motivation to search, and performance below aspiration provides this motivation. Second, organizations pursue a simple, narrowly delineated, and unambiguous objective through problemistic search to “mend performance shortfalls” (Greve, 2003a: 687). Although the existing literatures that have employed the idea of problemistic search are diverse, they are fairly consistent in theorizing about it. Organizations inherently use problemistic search as a means to engender organizational action and find solutions to the everyday challenges they face in a satisficing manner (Simon, 1955). Actions are evaluated on the basis of their ability to solve the problem — resolving the performance shortfall. Third, organizations are simple-minded in their search behavior. Problemistic search is typically viewed as occurring in the vicinity of current knowledge, practices, and expertise (Cyert & March, 1963;

Greve, 2003c). Only when a solution cannot be found in the vicinity of the firm's existing knowledge does the organization gradually move towards more distant search.

## 2.2. Methodology of Literature Review

To identify the relevant literature for this review we followed a structured process. We started with a broad search on google scholar using the terms "problemistic search cyert march". This search revealed approximately 2440 results (in October 2016).<sup>1</sup> However, a large share of the papers in this set reference problemistic search ritualistically, employing the terminology without engaging with the substance of the concept, and often only contain singular mentions of problemistic search in the form of a side or subsidiary argument.

In order to ensure an appropriate scope and a consistent coverage of the relevant literature on problemistic search, we conducted several additional steps to develop a narrower group of core papers. First, to identify papers related to problemistic search, we conducted five independent searches with distinct keyword combinations: (Cyert March "problemistic search"), (Cyert March satisfice OR satisficing), (Cyert March aspiration OR aspirations), (Cyert March "performance feedback"), and (Cyert March search). Second, we restricted the search to eight leading journals in our field (Academy of Management Journal, Academy of Management Review, Administrative Science Quarterly, Management Science, Organization Science, Journal of Management, Journal of Management Studies, Strategic Management Journal). Because the fifth keyword combination (Cyert March search) produced overly broad results even with these restrictions, we applied additional criteria for the results from that last keyword combination. Specifically, we included a

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<sup>1</sup> We decided to employ google scholar after testing and cross comparing google scholar with other search engines, including ISI Web of Knowledge and Ebsco Business Source Complete. Google scholar provided greater and more consistent search results because it matches keywords not only on title and abstract, but also, in many cases, the main text body.

paper retrieved from searching “Cyert March search,” only if it either has more than 300 citation counts or was published after 2011. This step reduced the sample size to 594. Third, after examining the remaining articles, we excluded papers that discuss “problemistic search” as a marginal theme, or were well off topic. In other words, we excluded a paper if, even though it invokes the term “problemistic search,” the concepts of search and performance shortfall do not play a sufficiently substantive role in the theory. After executing this third step, the sample was reduced to 169 articles.

Fourth, we read the set of 169 articles to further validate their role in the problemistic search literature. Based on our reading, we excluded 42 papers that did not fall within the scope of our review. For example, we excluded papers that largely focused on individual, rather than organizational, search. By scanning the bibliographies of the 169 papers we identified additional papers not included in the original sample, typically because they are in books and secondary journals, or are working papers. Reading these papers led to the inclusion of 38 additional papers. Thus, after this stage, the sample included 165 papers on problemistic search.

Finally, as we will note in our discussion in the subsection titled “Solution Search and its Characteristics”, most of the literature on the search process would be classified under the broader heading of organizational search (because triggering by a problem is absent). Thus, we expanded the set of articles, on an ad hoc basis, to include relevant studies on the general search process. Doing so added 68 general search studies to our sample. Taken together, our final sample contains 233 articles, which form the basis of the literature review.<sup>2</sup>

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<sup>2</sup> In addition to the articles that speak directly to problemistic search and search in general, we also discuss, where appropriate, papers that shed light on problemistic search, but are not in the literatures associated with the behavioral theory of the firm. Likewise, the Agenda portion of our paper includes references to many studies that are not part of the literature on problemistic search. These studies are not included in the set of 233 papers.

### 2.3. Triggering Mechanisms of Problemistic Search

A key domain of research on problemistic search focuses on the mechanism that triggers problemistic search. The explicit claim in the literature of the Carnegie School tradition, and also common across other bodies of management scholarship (e.g., Argyris & Schön, 1978; Chandler, 1962), is that “poor performance is actually necessary to catalyze the search for new practices in an organization” (Bolton, 1993: 59).

We decompose research in this domain across two topics: the idea of an aspiration as a threshold for performance comparison and the dimensions of aspirations. We highlight the rather mechanistic, nearly automatic, view of search triggered when performance falls below the threshold defined by the aspiration. This view dominates the literature on triggers of problemistic search, but the empirical evidence regarding the triggering role of aspirations is surprisingly mixed. As a result, more recent literature considers how cognitive processes and the non-unitary nature of organizations (internal structure and coalitions of actors with diverging interests) bound the conditions under which underperformance leads to search. Finally, we highlight the need to develop a richer understanding of the cognitive processes underlying how an organization selects a social reference group, and the way historical and social aspirations are aggregated. Table 1 summarizes key arguments regarding the triggering mechanisms in problemistic search and lists selected example studies.

<< Insert Table 1 here >>

### *2.3.1. Aspiration as a threshold of problemistic search*

Simon (1959) was influenced by earlier work in psychology on individual level aspirations (e.g., Frank, 1935; Katona, 1953; Lewin, Dembo, & Festinger, 1944). Building on his own work on the role of individual aspirations in organizations (March & Simon, 1958), he argues that when “performance falls short of the level of aspiration, search behavior (particularly search for new alternatives of action) is induced” (Simon, 1959: 263).

This logic, at the organizational rather than individual level of analysis, forms the basis of the argument for triggering problemistic search. Cyert and March (1963) envision an organizational aspiration (goal, target) that is a function of a firm’s own prior performance, the historical aspiration, and the prior performance of a reference group of other firms, the social aspiration. A performance shortfall relative to the aspiration threshold is considered “the problem” in problemistic search. If existing behaviors are viewed as effective, a “firm is unlikely to change them; if not, search for better rules will be stimulated” (Winter, 1971: 245) since we assume firms “act in order to enhance their degree of success in achieving their aspirations” (Lant, 1992: 624). Performance above the aspiration level induces the firm to maintain the status quo and avoid actions that might entail a risk of reducing performance (Bromiley, Miller, & Rau, 2001; March & Shapira, 1987).

Despite the centrality of this triggering claim, empirical evidence is surprisingly mixed. In our review sample, we tabulate the empirical results of 53 studies that directly test the arguments on the threshold function of aspirations. They typically use a metric of performance relative to an aspiration as the independent variable, and a metric of change as the dependent variable (e.g., acquisitions, R&D spending). Table 2 summarizes these results. We distinguish among tests that

examine historical or social aspirations separately, as well as tests that use a combined aspiration (aggregating social and historical into a single aspiration). We also divide the results across two empirical methodologies: (i) a single continuous measure that captures performance relative to aspirations, and (ii) a spline specification, following Greve (1998), allowing for distinct coefficients on performance below and above aspirations. Because some studies report multiple tests, the number of results is greater than the number of studies.<sup>3</sup>

<< Insert Table 2 here >>

Consider, for example, studies using a continuous measure of performance (across all types of aspirations). Of these studies, twenty report statistically significant support for the claim that performance below aspiration triggers search and change, eight studies report mixed results, five studies report a non-significant coefficient, and three studies report coefficients that are statistically significant but in the opposite direction (i.e., performance below the aspiration decreases change). Spline studies may report tests of the significance of the below- and/or above-aspiration coefficient, which are reported in the table. Of the spline method studies, 32 include both above- and below-aspiration performance variables in their model. These studies also suggest mixed results. Although not reported in the table, but of substantial importance, only 16 of these spline studies test the difference between the below- and above-aspiration coefficients. Of those, six report performance below aspiration leads to more change than performance above aspiration, consistent with the prediction of problemistic search; two report mixed results, and the remainder report results that conflict with problemistic search theory.

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<sup>3</sup> Our tabulation of empirical results is a first step in developing a deeper understanding of the aggregate results of these empirical tests, but it is not a full substitute for a meta analysis.

Among these mixed results, one active area of research focuses on the boundary conditions around the claim that a performance shortfall relative to an aspiration gives rise to search and change. We highlight three such lines of research. The first line of research examining boundary conditions to the performance shortfall – search relationship comes directly from Cyert and March (1963). They theorize that organizations typically pursue multiple goals. Consequently, managerial attention to these goals may be a crucial moderator of problemistic search (Greve, 2008a; Ocasio, 2011). Recognizing the potential importance of organizational attention, several scholars have empirically examined whether and how a shift of attention influences the search trigger (Blettner, He, Hu, & Bettis, 2015; Li, Maggitti, Smith, Tesluk, & Katila, 2013; Washburn & Bromiley, 2012). Attention shifts in problemistic search can be broadly categorized into three types: a shift to different reference performance levels regarding the same aspiration (e.g., Audia & Greve, 2006; Blettner et al., 2015; Chen & Miller, 2007; Desai, 2008; Greve, 2010; Iyer & Miller, 2008; Joseph & Gaba, 2015; Lehman & Hahn, 2012; Lehman, Hahn, Ramanujam, & Alge, 2011; Miller & Chen, 2004; Ref & Shapira, 2017); a shift from social to historical aspirations and vice versa (e.g., Blettner et al., 2015; Bromiley, 1991; Deephouse & Wiseman, 2000); and a shift across different goals (e.g., Greve, 2008a; Vissa, Greve, & Chen, 2010). Despite the theoretical importance of the issue and research efforts invested, Blettner and colleagues (2015) point out further research is warranted to build a more concrete understanding about the relationship between attention and aspirations. For example, while some studies (e.g., Blettner et al., 2015; Iyer & Miller, 2008; Lehman & Hahn, 2012; Lehman et al., 2011) find support for the attention shift model between multiple reference points, Chen and Miller (2007) fail to find evidence of attention shift in the context of problemistic search and instead suggest multiple foci of attention may coexist.

A second line of research suggests that psychological factors may also limit the extent to which performance below an aspiration triggers search. For instance, Jordan and Audia (2012) theorize that managers have a self-enhancement motive, seeking to view themselves in a positive light; managers may retrospectively distort the gap between performance and aspirations, reducing the likelihood that search is triggered. The authors suggest that high levels of narcissism, accountability, and informational ambiguity can increase decision makers' propensity to assess performance in a self-enhancing way. Other research in that stream focuses on the choice of the reference group (Audia, Brion, & Greve, 2015) or failure attribution (Desai, 2015) as psychological processes that may limit triggering search. Such psychological processes may have particularly strong influence when performance feedback is difficult to interpret (Joseph & Gaba, 2015) or when the results of performance comparison to own historical performance and the performance of social reference groups are not consistent (Baum, Rowley, Shipilov, & Chuang, 2005; Bromiley & Harris, 2014).

Finally, a third line of research focuses on differences across groups of individuals or corporate units within an organization as a mechanism that may inhibit triggering problemistic search, an idea inherent to the notion of coalitions and conflict in Cyert and March (1963). While most research on problemistic search assumes a unitary actor, thereby ignoring these issues, recent studies theorize and empirically demonstrate that corporate structure (Gaba & Joseph, 2013) and multiple groups of decision makers with divergent interests (Desai, 2016b) influence the triggering of problemistic search.

In sum, substantial progress linking performance below an aspiration to subsequent problemistic search has been made, as Cyert and March (1963) postulated. While the empirical



results are somewhat mixed, the literature has begun to make progress by examining cognitive and structural mechanisms that might act as boundary conditions on the triggering claim. Later in this paper, we will note that most empirical studies blackbox the search process itself (data limitations restrict observation to the outcome rather than the process of search), which may also account for some of the mixed empirical results.

### *2.3.2. Dimensions of aspirations*

Given that aspirations are integral to triggering problemistic search, they have been the subject of a large body of research. We focus our discussion on two key dimensions of aspirations: the performance metric on which aspirations are based, and the construction of the reference point, historical (own) or social (others') performance. We put aside the issue of aspiration adaptation, because it has received detailed coverage in two recent reviews (Bromiley & Harris, 2014; Shinkle, 2012). Our discussion highlights the myriad of potentially conflicting bases on which aspirations may be formed, and points to the need for a richer cognitive view of aspirations.

*Performance metrics of aspirations.* The central feature of aspirations in the behavioral theory of the firm is that they are backward-looking targets, based on experience, rather than forward-looking calculations, based on expectations (Arrfelt, Wiseman, & Hult, 2013; Greve, 2003c). Lant and Shapira (2008: 60) state that a “key assumption of the behavioral theory of the firm is that firms adjust their behavior in response to their experience rather than acting on their expectations of future states of the world.”

While aspirations are broadly conceived as goals or targets in Cyert and March (1963), the literature on problemistic search is largely empirically-oriented; it tends to focus somewhat

narrowly on high-level financial performance as the aspiration. Measures of profitability are perhaps the most commonly studied bases for performance aspirations (e.g., Audia, Locke, & Smith, 2000; Bromiley, 1991; Greve, 2003a; Greve, 2003b; Lant, Milliken, & Batra, 1992; Miller & Chen, 2004). Among the sample of 53 empirical papers described in Table 2, return on assets (e.g., Greve, 2003a; Miller & Chen, 2004) is the most used performance metric (29 studies), while other studies take different profitability metrics such as return on equity (5 studies; e.g., Audia & Greve, 2006; Miller & Bromiley, 1990) or return on sales (2 studies: Audia et al., 2000; Wiseman & Bromiley, 1996) as their primary financial performance measure.

A much smaller set of studies investigates non-financial goals. These aspirations are often more specific than high-level financial goals (e.g., Ketchen & Palmer, 1999), and in some cases may reside at the unit level rather than at the firm level (e.g., Aranda, Arellano, & Davila, 2017). Non-financial goals include new product development performance (Tyler & Caner, 2016), hospital occupancy (Ketchen & Palmer, 1999), innovation (Gaba & Bhattacharya, 2012), market share (Baum et al., 2005; Greve, 1998), firm size and growth (Greve, 2008a), team ranking or scores in sports games (Lehman & Hahn, 2012; Moliterno, Beck, Beckman, & Meyer, 2014) and product quality (Parker, Krause & Covin, 2017) to name only a subset of the broad variety of goals studied.

Managers may base their aspirations on many different goals and associated metrics. It seems likely that at least some of the mixed empirical findings discussed earlier may be explained by a mismatch between the aspiration measured in a study, and the true latent aspiration employed by managers. From a theoretical perspective, different aspiration metrics could lead to different levels and direction of responses to a performance shortfall. Moreover, the broad variety of different measures gives rise to the possibility that managers may utilize the choice of goals

and associated metrics to enhance their own interests (Audia & Brion, 2007). Greve (2003c: 70) suggests that at the organizational level the choice of goals and metrics is a process characterized by “precedence, politics, payoffs, and proselytizing”. At the moment, we have little insight into how managers choose which metrics are salient, particularly with respect to financial metrics that are rather close substitutes. Indeed, as we highlight below, the choice of metric may represent an important cognitive component of problemistic search that is yet to be satisfactorily addressed.

*Historical and social bases of aspirations.* Cyert and March (1963: 115) identify three backward-looking components of aspirations that additively determine the aspiration in a given time period: “the organization’s past goal [prior aspirations], the organization’s past performance [historical component], and the past performance of other ‘comparable’ organizations [social component].” As we point out below, empirically testing the implications of a performance shortfall on the basis of either historical or social aspirations for subsequent change has produced mixed support (see Table 2). The empirical challenge is particularly acute for studies of social aspirations as the theoretical frameworks are less well developed (Boyle & Shapira, 2012; Moliterno et al., 2014).

The first dimension of an aspiration is based on historical comparison — appraising performance today relative to performance in the prior period, or the average over a set of prior periods. A firm’s own past performance is an indicator of how well a firm can and should do in its environment, and may be premised on any of the measures we discussed earlier. Experiments by Lant (1992) and Lant and Montgomery (1987) provide evidence that history of past performance contributes to the formation of aspirations. Empirical studies using organization data also show that past performance affects the level of aspirations (Mezias et al., 2002; Mezias & Murphy, 1998).

Several specifications have been used to measure historical aspirations. Some studies use the firm's previous period performance as the historical aspiration level (e.g., Lim, & McCann, 2013; Ref & Shapira, 2017). Other studies use the simple average of past performances over multiple periods (e.g., Arrfelt et al., 2013). The weighted moving average of prior historical aspirations and the current or most recent performance has been among the most frequently used specification (e.g., Greve, 1998, 2003a; Kacperczyk, Beckman, & Moliterno, 2015; Kuusela, Keil, & Maula, 2017; Tyler & Caner, 2016).

While evidence from empirical studies of historical aspirations is typically viewed as providing stronger support for the theory than studies based on social aspirations (Boyle & Shapira, 2012; Ref & Shapira, 2017), our tabulated results in Table 2 suggest that this is not the case — evidence for both is mixed. A substantial number of studies support the claim that performance below historical aspirations influences organizational behavior by triggering problemistic search that leads to change (e.g., Baum et al., 2005; Chen & Miller, 2007; Greve, 1998; Miller & Chen, 2004). Many other studies, however, find either a nonsignificant result (e.g., Greve, 2003b) or report statistically significant results in the opposite direction, with a performance shortfall relative to a historical aspiration leading to decreased search or change (e.g., Iyer & Miller, 2008).

The second dimension of an aspiration is based on social comparison — appraising performance today relative to that of firms in a reference group. If the focal firm's performance is perceived to be lower than the performance level of other firms in the reference group, we expect the focal firm to recognize that the performance gap is a problem, and, consequently, initiate problemistic search. Work on social aspirations has a classic psychological foundation. As

Massini, Lewin, and Greve (2005) note, research on the “level of aspiration (Lewin et al., 1944) and social comparison theory (Festinger, 1954) suggest that individuals use a reference group that reflects the average performance of peers.”

Despite the theoretical appeal of the concept of social aspirations and the rich body of research (e.g., Baum et al., 2005; Greve, 1995; Greve, 1998; Harris & Bromiley, 2007; Iyer & Miller, 2008; Ketchen & Palmer, 1999), empirical studies of the link between social aspirations and subsequent organizational change yields mixed findings, as our results in Table 2 suggest. While many studies find, consistent with problemistic search theory, that performance below the social aspiration stimulates more or riskier organizational change (e.g., Baum et al., 2005; Harris & Bromiley, 2007; Ketchen & Palmer, 1999; Labianca, Fairbank, Andreovski, & Parzen, 2009), others find no effect (Audia & Greve, 2006; Desai, 2008; Lim & McCann, 2013) or an opposite relationship (e.g., Bromiley & Washburn, 2011; Iyer & Miller, 2008).

The mixed evidence on the role of social aspirations may be a result of the differences across studies in the assumptions, upon which reference groups are formed (Baum & Dahlin, 2007; Labianca et al., 2009; Short & Palmer, 2003). Many studies regard industry membership as the defining feature of reference groups (Greve, 2008a), with social aspirations measured by average (e.g., Baum et al., 2005) or median (e.g., Iyer & Miller, 2008) industry performance. A more serious issue, one that goes beyond simple measurement, relates to the large number of dimensions on which a reference group might be constructed. Greve (1998) notes a broad array of variables, beyond industry, that may be important for determining the reference group: size, physical proximity, performance, products, markets, and production methods may all be relevant. Moreover, as Audia et al. (2015) argue, by building on the psychological construct of self-enhancement motives, managers may select reference groups in a strategic manner such that

they are able to view themselves in a favorable light. The challenge of empirically studying social aspirations and problemistic search may be further compounded because firms may have multiple simultaneous reference groups (e.g., Moliterno et al., 2014), both within and outside the organization (Kacperczyk et al., 2015).

The challenge with specifying social aspirations is not simply empirical, but rather, reflects a lack of understanding of how firms form reference groups for the social component of aspirations. Cyert and March (1963) provide little guidance in this respect. In our view, progress may require an in-depth consideration of the cognitive processes underlying the social construction of reference groups. Given the limited consideration of cognition in the classical formulation of problemistic search, these cognitive processes have largely been overlooked. Yet research outside of the behavioral theory of the firm offers some suggestive evidence. A number of studies examine how firms identify others as rivals, worthy of attention, and perhaps social comparison (e.g., Clark & Montgomery, 1999; Kilduff, Elfenbein, & Staw, 2010; Panagiotou, 2007; Porac, Thomas, & Baden-Fuller, 1989). For instance, Fiegenbaum, Hart, and Schendel (1996) argue in their conceptual paper that strategic groups may serve as more effective comparison targets for the firms than the more general construct of industry and as a result, firms within an industry may have different reference groups.

The aggregation of historical and social components of aspirations is also a domain in need of a richer cognitive lens. While Cyert and March (1963: 123) formulate an additive model of historical and social aspirations into a single aspiration, alternative proposals have been offered and no consensus on the correct conceptualization and measurement has emerged (Bromiley & Harris, 2014). Studies attempting to explicitly incorporate both historical and social aspirations have done so in a variety of ways. One approach is to aggregate social and historical aspirations

to a single scale, for instance, using a weighted average of the two (e.g., Greve, 2003a; Parker et al., 2017). However, Washburn and Bromiley (2012) question this approach based on the empirical results in their study. Another approach is to use distinct measures for social and historical aspirations and propose separate hypotheses for them (e.g., Baum & Dahlin, 2007; Baum et al., 2005; Greve, 1998). Other studies propose a theoretical mechanism by which firms switch attention between historical and social aspirations, suggesting that each aspiration type is associated with a different underlying organizational process. Such models frequently assume that organizations utilize different aspirations depending on their own performance level (e.g., Bromiley, 1991; Deephouse & Wiseman, 2000; Park, 2007; Washburn & Bromiley, 2012; Wiseman & Bromiley, 1996), positing, for example, that organizations sequentially reallocate their attention from historical aspirations to social aspirations as their performance increases or vice versa. This dynamic may be important if responses to historical aspirations differ from responses to social aspirations (e.g., Kim, Finkelstein, & Halebian, 2015).

In sum, the basic logic of aspirations as a trigger for problemistic search is compelling. In practice, however, our understanding is limited. The simple claim that a firm's aspirations are a function of own historical performance and a social reference group's performance is undermined by the myriad of ways in which different metrics of performance, and different social reference groups, can be constructed and combined. Thus, there seems to be no one simple rule for constructing an aspiration. The resulting ambiguity surrounding the aspiration, highlighted recently by Greve and Gaba (2017), suggests to us that progress will demand theorizing underpinned by a richer cognitive model of problemistic search.

## 2.4. Solution Search and Its Characteristics

In their seminal work, Cyert and March (1963) argue that, given a performance shortfall, search for a solution that restores performance is predominantly local, conducted in the vicinity of the problem symptom and previously adopted actions, and intensified as the size of the performance shortfall increases.

While the literature on the characteristics of search, as a more general theoretical construct associated with decision-making by boundedly rational firms, is fairly large, the literature on the search for solutions triggered by, and oriented toward, the solution of a specific problem is limited. Most research occurs under the broader heading of organizational search (e.g., Katila & Ahuja, 2002; Levinthal, 1997; Rosenkopf & Nerkar, 2001; Afuah & Tucci, 2012), which includes a range of search processes such as slack search (Chen, 2008; Cyert & March, 1963) and institutionalized search (Chen & Miller, 2007; Greve, 2003c). These processes may have very different characteristics than problemistic search since they are not triggered by a problem. In this sense, research on problemistic search has largely blackboxed the search process itself, examining triggers and outcomes, but not the process of search for solutions to problems. In our discussion below, we draw inference about problemistic search based on a discussion of elements of this broader body of search literature, focusing on the locus of search, online versus offline evaluation of search, and the intensity of search.

The conclusions we draw from the literature on search point to three important gaps in our ability to empirically disentangle problemistic search from its behavioral consequences, such as change, and the need to move beyond the overly restrictive conceptualization of problemistic search as highly mechanistic — an automatic process that involves minimal cognition. First,



theoretical work highlights a variety of mechanisms, often demanding higher level cognitive ability, which lead to search that is less local, less exploitative. Second, little empirical evidence exists to suggest that the evaluation of the merits of alternative solutions identified via search is of the low-cognition “online” form. Indeed, there is probably good reason to believe that evaluation is conducted at least partially “offline”, for instance, by managers relying on their mental models. Third, we have a limited understanding of the drivers of search intensity, in part because problemistic search is hard to disentangle from alternative search processes (slack and institutionalized search) in empirical studies, and the existence of alternative theoretical mechanisms that might also impact the intensity of search (e.g., threat rigidity). Table 3 summarizes key arguments regarding solution search and lists selected example studies.

<< Insert Table 3 here >>

#### *2.4.1. Locus of problemistic search*

March and Simon (1958) and Cyert and March (1963) were relatively precise in their predictions that search triggered by a performance shortfall would be predominantly local in nature. Jung and Lee (2016: 1729) summarize the assumption of local search as follows: Firms start “searching knowledge that is familiar (Fleming, 2001), or closely related to firms’ existing expertise (Katila & Ahuja, 2002), or searching for a solution that is in the neighborhood of current expertise (Rosenkopf & Nerkar, 2001).” For instance, March (1994: 28) suggests that “if sales fall in Texas, then they look for the problem and the solution in Texas.” Likewise, a firm experiencing a new product development rate below aspiration level would be expected to start searching for solutions by tinkering with R&D related organizational practices (Tyler & Caner, 2016). Given the theorized reliance on local search, problemistic search has been characterized as

path-dependent (Ahuja & Katila, 2004; Cyert & March, 1963; Miller, 1994; Rhee & Kim, 2015), leading primarily to exploitation in the sense of incremental refinement of previously adopted organizational activities (March, 1991). However, as we will discuss, recent research on search highlights the mechanisms by which search in general, and by inference, problemistic search, may be less exploitative than previously thought.

Organizational search is theorized to be local based on a number of supporting rationales. First, local search exhibits distinct advantages relative to more distant search (e.g., Helfat, 1994; Laursen, 2012; Nelson & Winter, 1982). Organizations and their decision makers' cognitive limitations make it difficult for the organization to become aware of, and able to evaluate, all alternatives that may be relevant for solving a problem (Knudsen & Levinthal, 2007; Simon, 1978b). Second, organizations possess a limited knowledge base. Given that learning is easier in domains where the organization holds knowledge or at least possesses related knowledge (Knudsen & Levinthal, 2007), search will be facilitated in the (local) areas where the organization has current expertise (Helfat, 1994). Third, local search may produce better performance, at least in the short run (Denrell & March, 2001; Taylor & Greve, 2006). Related to the latter point, the cost of local search may be lower than that of more distant search because the former avoids the cost of communicating across knowledge domains (Carlile, 2002; Laursen, 2012).

Perhaps because the theoretical logic supporting the localness of organizational search is so compelling, the empirical base of direct evidence in support of localness is somewhat slender and mostly outside the domain of research on problemistic search. Laursen (2012) provides a brief review of this work. Key studies that lend support to the dominance of local search are Stuart and Podolny (1996), Martin and Mitchell (1998), and Katila and Ahuja (2002), all outside of the core literature of problemistic search. Finally, in a lab study examining the nature of

individual search on a rugged landscape, Billinger, Stieglitz, and Schumacher (2014: 93) observe, “Success narrows down search to the neighborhood of the status quo, whereas failure promotes gradually more exploratory search.”

Local search has a number of downsides. In particular, local search is less likely to generate the variety required to solve novel problems and to generate innovative solutions (Fleming & Sorenson, 2004; Katila, 2002), in part, because it tends to draw upon related knowledge in a manner that limits the extent of recombination (Fleming, 2001). Local search may be particularly problematic in complex environments (characterized by rugged performance landscapes) because possibilities for substantial performance improvement are less likely to reside in the vicinity of current practices and routines, and thus, local search may not identify these superior positions, stalling at lower quality solutions (Levinthal, 1997; Puranam, Stieglitz, Osman, & Pillutla, 2015).

These well recognized limitations of local search have spawned a rich literature, both theoretical (e.g., March, 1991; Levinthal & March, 1993; Gavetti & Levinthal, 2000) and empirical (e.g., Fleming & Sorenson, 2004; Katila & Ahuja, 2002; Rosenkopf & Almeida, 2003; Rosenkopf & Nerkar, 2001), which identifies mechanisms organizations utilize to overcome tendencies towards local search. One stream of studies investigates the important role of variation among organizational members in enabling an organization to search a broader area of the solution landscape (e.g., Beckman, 2006; Rosenkopf & Almeida, 2003). A second stream investigates a variety of managerial approaches within the organization under the heading of ambidexterity (Gupta, Smith, & Shalley, 2006; Lavie, Stettner, & Tushman, 2010; Raisch & Birkinshaw, 2008). A third stream investigates how drawing upon actors outside the organization’s boundaries may facilitate broader search (Laursen & Salter, 2006; Rothaermel &

Deeds, 2004; Schildt, Maula, & Keil, 2005; Wadhwa & Kotha, 2006). Theoretical work complements this research by pointing to a variety of mechanisms, often demanding higher level cognitive ability, that allows exploration of more distant locations in the search space (e.g., Baumann & Siggelkow, 2013; Csaszar & Siggelkow, 2010; Ethiraj, Levinthal, & Roy, 2008; Gavetti & Levinthal, 2000; Rivkin, 2000; Rivkin & Siggelkow, 2003; Siggelkow, 2002; Siggelkow & Rivkin, 2005).

The research on how firms may overcome localness in organizational search, along with a substantial literature highlighting the merits of broader search (e.g., Baum & Dahlin, 2007; Dahlander, O'Mahony, & Gann, 2016), is suggestive of the possibility that problemistic search may be less exploitative than suggested by the original conceptualization in March and Simon (1958) and Cyert and March (1963). For instance, Billinger et al.'s (2014: 93) lab study of individual search on a rugged landscape suggests that "human participants were prone to over-exploration, since they broke off the search for local improvements too early." Posen and Chen (2013), in a study of learning curves of U.S. commercial banks, find that firms tend to seek and learn from external knowledge when their performance is below their aspiration, with a stronger effect for entrants than incumbents. Ben-Oz and Greve (2015: 1827) conclude that "performance relative to aspiration levels has effects on long-term strategic actions as well as short-term ones, and thus argue against strict myopia." Moreover, search may be multidimensional. Organizations may focus on exploitation through local search along one dimension, such as relative to the firm's knowledge base and routines (e.g., Helfat, 1994; Katila & Ahuja, 2002; Stuart & Podolny, 1996; Fleming & Sorenson, 2004), yet may explore more distantly along another dimension, such as relative to the firm's boundary (e.g., Rosenkopf & Nerkar, 2001).

#### *2.4.2. Online versus offline evaluation in problemistic search*

In their conceptualization of problemistic search, Cyert and March (1963) specify search as the activity organizations engage in to create and consider solution candidates to address a performance shortfall. Their formulation of problemistic search was purposely devoid of a substantial cognitive component in order to create a counterposition to the overly rational view of contemporary economics. This has an important bearing on our understanding of how alternative solutions are evaluated as firms engage in search for solutions, and consequently, we are unable to disentangle problemistic search from its behavioral consequences, such as change.

Research on organizational search, as a more general theoretical construct, includes two very different types of performance evaluations: online and offline search (Gavetti & Levinthal, 2000; Knudsen & Levinthal, 2007; Levinthal & Posen, 2007; Lippman & McCall, 1976). The latter demands substantial cognitive capacity (Gavetti & Levinthal, 2000) and appears to contrast with basic tenets of problemistic search.

Online search refers to search activities in which the organization must, at least partially, implement a solution alternative in order to evaluate its merits (Gavetti & Levinthal, 2000). This activity may take the form of a series of revisions to an ongoing organizational process where the organization evaluates performance feedback at every step and adjusts the process according to that feedback (Gavetti & Levinthal, 2000; Levitt & March, 1988). Online evaluation may be necessitated by limited organizational cognition, but is feasible primarily when alternatives can be relatively easily implemented with limited costs, and when changes do not leave an irreversible legacy (Winter, Cattani, & Dorsch, 2007). While the advantage of online evaluation is learning about the merits of an alternative based upon real world outcomes, the merits of doing so may be

reduced if the task environment is characterized by noisy feedback (March & Olsen, 1976; Posen & Levinthal, 2012), delayed feedback (Rahmandad, 2008; Rahmandad, Repenning, & Sterman, 2009), or when feedback can be observed only after a sequence of actions (Denrell, Fang, & Levinthal, 2004; Fang, 2012; Fang & Levinthal, 2009).

Offline search, in contrast, refers to search activities in which the organization explores alternative solution candidates without making changes to its existing activities. A firm evaluates an alternative against its understanding of the world in order to assess the likely implications of implementation (Csaszar & Levinthal, 2016; Gavetti & Levinthal, 2000; Martignoni, Menon, & Siggelkow, 2016; Posen & Levinthal, 2012). To do so, the firm may use managers' mental models, business planning, thought experiments, theoretical calculations, formal models, simulations, laboratory experiments, and organizational pilots (Winter et al., 2007). Offline search allows the organization to consider a larger set of alternatives because costly implementation of an alternative will occur only if the offline evaluation suggests that the alternative is effective at improving performance.

Effective offline search requires substantial cognitive capabilities to correctly evaluate the merits of search alternatives (Gavetti & Levinthal, 2000). The low-cognition theory of problemistic search offered by Cyert and March (1963) seems to rule out offline evaluation; however, there is little evidence to support the claim that problemistic search is predominantly characterized by online evaluation of alternatives.

Most empirical studies considering performance feedback may be read as implicitly assuming that search is online (e.g., Audia & Greve, 2006; Greve, 1998; Harris & Bromiley, 2007; Iyer & Miller, 2008) given that, for pragmatic reasons, studies focus on externally visible

organizational changes made by the organization — changes that have been implemented. Consider Greve's (1998) study of radio format changes or Audia and Greve's (2006) study of factory expansions in the shipbuilding industry; inference about problemistic search from observing such change must reflect one of two assumptions. Each observed change may be an online evaluation of an alternative (potential) solution during an ongoing process of search. Alternatively, each observed change reflects a solution that has been implemented after a prolonged period of unobserved offline search. To the extent the latter is the case, or problemistic search involves both offline and online evaluation, extant research may be ignoring the majority of early stage search activities that may have been evaluated offline and may not lead to observed organizational change. Only a few studies attempt to capture search directly, for instance, through R&D expenditures (Chen, 2008; Chen & Miller, 2007); these studies focus on search intensity thereby sidestepping the issue of online and offline evaluation in the search process.

Because of the ambiguity in the literature about the nature of evaluation of the merits of alternative solutions discovered via search, important gaps exist, both in disentangling problemistic search from its behavioral consequences such as change, and in understanding the conditions under which problemistic search employs cognitive processes that facilitate offline evaluation. Even if the search for solutions to problems is mostly online (low-cognition evaluation), organizations surely engage in some offline evaluation of alternatives (high-cognition evaluation). We have limited understanding of when online versus offline evaluation is used during problemistic search. Moreover, empirical research that focuses only on externally visible organizational change may arrive at incomplete or faulty conclusions given that it ignores a potentially important element of how alternative solutions are evaluated in the search process.

#### *2.4.3. Intensity of problemistic search*

The intensity of search refers to the level of resources invested by firms to conduct problemistic search. The extant literature highlights two factors that impact search intensity: the size of the performance shortfall that determines the motivation to engage in problemistic search, and the availability of resources that determines the feasibility of engaging in problemistic search. As we highlight below, our understanding of the drivers of search intensity is limited because empirical work is challenged by confounding effects of other types of search processes (e.g., slack search).

Cyert and March (1963: 116) note that the intensity of search is dependent upon “the extent to which goals are achieved,” implying that search activities become more or less intense depending on how far performance deviates from the aspiration level. The greater the distance between current below-aspiration performance and the aspiration level, the greater the resources invested in problemistic search. Studies that examine behavioral outcomes measured with dollar inputs, for instance, R&D expenditures (e.g., Chen, 2008; Chen & Miller, 2007), marketing expenditures (Vissa et al., 2010), and investment in capital assets (Arrfelt et al., 2013) are one type of evidence for this claim. Among the 14 studies in our review that examine this relationship, seven support the claim (e.g., Chen & Miller, 2007), three find non-significant results (e.g., Greve, 2003b), and four find a relationship in the opposite direction (e.g., Bromiley & Washburn, 2011).

Both theoretical and empirical challenges limit our understanding of how the magnitude of a performance shortfall impacts the intensity of problemistic search. Empirical testing of the relationship between search intensity and the magnitude of the performance shortfall is



challenging because most empirical studies are unable to distinguish between distinct types of search processes. Greve (2003c) notes, tests of the relationship between search intensity and the size of a performance shortfall may confound problemistic search with institutionalized search. Institutionalized search is routine search activity conducted even in the absence of particular triggers (Dosi, 1988; Patel & Pavitt, 1997). The few studies that explicitly account for such effects (e.g., Antonelli, 1989; Chen & Miller, 2007; Gubbi, Aulakh, & Ray, 2015) find that both search processes are present, suggesting that studies that do not explicitly control for the institutionalized component of search may misidentify the impact of a performance shortfall on the intensity of problemistic search.

Research suggests an alternative relationship between the magnitude of a performance shortfall and the intensity of problemistic search. March and Shapira (1987), drawing upon work on threat rigidity (Staw, Sandelands, & Dutton, 1981), argue that under severe threat, such as bankruptcy, firms may shift attention away from the performance based aspiration to a survival goal, and search intensity will diminish. In line with this argument, Chen and Miller (2007) find that proximity to bankruptcy is negatively related to R&D intensity. Studies have sought to reconcile these alternative predictions by testing threat rigidity as an alternative or parallel response to problemistic search (e.g., Shimizu, 2007; Iyer & Miller, 2008) or by examining contingencies such as organizational power concentration, top management diversity, firm size, age, and experience, which may moderate the relationship between the size of the performance shortfall and search intensity (e.g., March & Shapira, 1992; Mone, McKinley, & Barker, 1998; Audia & Greve, 2006; Desai, 2008). For example, Shimizu (2007) finds that firms' divestiture decisions are jointly determined by problemistic search, prospect theory, and threat rigidity.

In addition to the size of the performance shortfall, the availability of resources may also impact search intensity. The literature reveals conflicting arguments regarding the implications of such resources for the intensity of problemistic search. On one hand, to engage in problemistic search, a firm must carve out resources, either by using unused resources or by reducing the amount of resources invested in other activities. When resources are tied-up in current activities, search intensity may be constrained, while it may be strengthened when resources are more freely available (e.g., Greve, 2003c; Pitelis, 2007). On the other hand, Cyert and March (1963: 80) suggest slack resources cause managers to be less responsive to failure to meet their performance aspirations noting “search will be much more intensive where organizational slack is small than where it is large.” Slack resources, particularly financial slack, may serve to buffer adverse contingencies (Levinthal & March, 1981; Milliken & Lant, 1991), and inhibit the recognition of a problem or diminish the extent a larger performance shortfall increases the intensity of search. While substantial research emphasizes the idea that slack resources may lead to more search (e.g., Bromiley, 1991; Chen, 2008; Greve, 2003a; Chen & Miller, 2007; Singh, 1986), it may also lead to a reduction in problemistic search. In a recent study, Kuusela et al. (2017) suggest that slack may guide search direction and suppress search among some potential solutions.

## **2.5. Behavioral Consequences of Problemistic Search**

The behavioral consequences of problemistic search refer to the changes firms undertake in an effort to restore their performance above their aspiration. This topic is one of the most intensely studied within the field of the behavioral theory of the firm. In our discussion below, we break up the literature along the lines of organizational change and risk taking as the central behavioral consequences of problemistic search. In doing so, we reveal several salient features of

the literature, and a number of critical gaps. In particular, three issues stand out. First, the extant literature does not clearly distinguish change as the final outcome of search from change that is part of an ongoing process of search. Second, while search is assumed to be inherently exploitative, some of the behavioral consequences of problemistic search seem almost exploratory (e.g., R&D, distant tie formation, risk taking) based on the definitions in March (1991). We know little about the circumstances under which exploitative versus somewhat more exploratory changes are invoked, and likewise, conditions under which we will observe change versus risk taking. Third, current theorizing is largely unable to explain the direction of search and change in response to performance shortfalls. For instance, many studies examine performance shortfalls relative to a generic aspiration such as ROA, but each study examines a distinct, narrowly defined type of change. Table 4 summarizes key arguments regarding the behavioral consequences of problemistic search and lists selected example studies.

<< Insert Table 4 here >>

#### *2.5.1. Organizational change*

Since Manns and March (1978) presented the first empirical test of problemistic search, the extant literature includes a substantial body of research that examines organizational change that results from performance below aspirations. The basic empirical design is a regression of performance relative to an aspiration on a measure of organizational change; a wide range of such change measures are studied. The implementation of this research design is facilitated by the relative ease with which large-sample data can be collected, which includes both high-level performance (e.g., profitability) and high-level organizational change (e.g., mergers).

Prior studies investigate a large and rather diverse set of behavioral consequences of problemistic search that can be classified as organizational change. We separate these studies along two dimensions. The first dimension is specificity of the performance aspiration: specific (e.g., new product development productivity) or generic (e.g., ROA). The second dimension is specificity of the change, where we distinguish narrow (e.g., factory expansion) or broad (e.g., strategic reorientation) changes.

A small subset of studies examine performance shortfalls relative to generic aspirations (e.g., ROA, ROS). They also explore how these shortfalls trigger broad change in firms' strategic orientation, i.e., simultaneous change along a number of strategic dimensions (e.g., Audia et al., 2000; Lant et al., 1992; Miller & Chen, 1994).

Another group of studies examines performance shortfall relative to a specific aspiration that leads to a change narrowly matched to the aspiration. For instance, studies in this stream of work connect performance shortfalls regarding radio audience share with broadcasting format change (Greve, 1998), network centrality with distant tie formation (Baum et al., 2005), quiz show results with changes in next round betting size (Boyle & Shapira, 2012), or NFL game scores with the adoption of different attack options in the focal game (Lehman et al, 2011). While these studies show a direct link between a performance shortfall and subsequent organizational changes that can be interpreted to arise from problemistic search, they are frequently in very specific domains and results can only partially be generalized beyond that domain or beyond the specific measures in question.

A large body of work examines performance relative to a generic performance aspiration that leads to a narrowly defined change. In this group, ROA, in particular, is linked to a large

variety of organizational changes, including, for example, investment (Arrfelt et al., 2013), factory expansion (Audia & Greve, 2006), risk-taking (Bromiley, 1991), R&D expenditures (Chen, 2008; Chen & Miller, 2007), acquisitions (Iyer & Miller, 2008), divestiture (Kuusela et al., 2017; Moliterno & Wiersema, 2007), innovation (Greve, 2003a), accounting misrepresentation (Harris & Bromiley, 2007), strategic convergence towards other firms (Park, 2007), entry to a new market (Ref & Shapira, 2017), and marketing (Vissa et al., 2010). While these studies may be more easily comparable given the generic performance aspiration, they raise a challenging question that research to date has failed to fully address: Why does a performance shortfall in ROA observed in one study lead to one type of change, and to a different type of change in another study?

These results point to a number of important gaps in our understanding of how performance shortfalls lead to organizational change. First, and most central, the detailed process of search is rarely examined in studies that model the correlation between the performance relative to aspirations and observed organizational change (because observed change may represent, in part, the final outcome of prolonged unobserved offline search and evaluation). An implication of blackboxing the search process is that extant research tends to leave unanswered the question of why a generic performance shortfall at the firm level (e.g., sales or ROA) leads to one specific type of change rather than another (e.g., M&A rather than R&D investment), an issue previously raised in the literature (e.g., Argote & Greve, 2007; Greve, 2008a; Kuusela et al., 2017). It seems likely that a deeper understanding of this linkage will require richer theorizing about how the characteristics of a performance shortfall impact search.

A recent paper by Kuusela et al. (2017) suggests one way to make progress. They theorize and find that a performance shortfall relative to a ROA aspiration might trigger one of two

different types of organizational change, an acquisition or divestiture, depending on the level of slack resources. Another approach would be to consider the role of cognition. For instance, prior research, outside of the literature on problemistic search, suggests that cognitive biases affect the choice of alliances and acquisitions (Duhaime & Schwenk, 1985; Tyler & Steensma, 1998). Finally, the non-unitary nature of organizations, with internal organization structures and coalitions of actors with diverging interests, may impact the direction of search.

A second gap relates to the assumption that problemistic search is predominantly exploitative (Greve, 2003c; Greve, 2007). While most research does not explicitly examine this assumption, a closer examination of the behaviors identified in response to performance shortfalls suggest that many can be classified, to some extent, as exploratory. For instance, research and development may be geared to both exploration and exploitation. While some studies suggest that R&D in response to performance shortfalls focuses mostly on exploitation (Greve, 2007), others find that firms may choose exploration, for instance through R&D alliances, in the face of performance below aspirations (Tyler & Caner, 2016). Baum et al. (2005) examine a sample of banking syndicates, finding that investment banks increasingly leverage non-local ties when performance is below aspirations, a type of behavior that is somewhat more exploratory. Moreover, to the extent exploration is riskier than exploitation (March, 1991), work on risk taking in response to a performance shortfall, which we discuss next, can perhaps be seen as weak evidence for exploration.

Research on problemistic search tends to assume that only organizational change oriented to resolving the focal problem is likely to covary with the performance shortfall of interest. However, we know from research on innovation (e.g., Austin, Devin, & Sullivan, 2012; Cohen & Levinthal, 1994; Miner, Bassoff, & Moorman, 2001) that search may generate ancillary

outcomes, which are not geared towards the focal task, but may prove valuable in other contexts and therefore may be adopted by the organization. It seems likely that search in response to performance shortfalls may generate a number of solutions that are not adopted to solve the focal problem, yet may be subsequently adopted to address different problems.

### *2.5.2. Risk taking*

The original conceptualization of problemistic search does not explicitly theorize changes in risk taking as a behavioral consequence of a performance shortfall (Argote & Greve, 2007). Only much later, in work by March and Shapira, does risk taking behavior become associated with problemistic search (March & Shapira, 1987; March & Shapira, 1992; Shapira, 1995).

A body of empirical research has since emerged that, drawing upon the logic of problemistic search and the Carnegie tradition more broadly, suggests that failure to meet aspirations may induce decision makers to accept higher risks (e.g., Boyle & Shapira, 2012; Bromiley, 1991; Fiegenbaum, 1990; Fiegenbaum & Thomas, 1988; Gooding, Goel, & Wiseman, 1996; Greve, 2003a, 2008b; Miller & Leiblein, 1996). Empirical studies measure risk in a variety of ways. Bromiley (1991) and Wiseman and Bromiley (1996), for example, measure risk as variance in analyst forecasts. Palmer and Wiseman (1999) decompose risk taking into two distinct metrics, organizational risk taking as measured by variance in ROA and managerial risk taking measured by diversification. Many papers treat change in R&D levels, or R&D intensity, as reflecting a change in risk taking (e.g., Miller & Bromiley, 1990).

Other studies, however, suggest a very different relationship between performance shortfalls and risk taking (see Klingebiel, 2017, for a recent discussion). This work often draws on threat rigidity arguments, suggesting that, at least for large performance shortfalls, organizations

respond with reduced risk taking in order to ensure survival. Several studies find that organizations close to bankruptcy attempt to reduce risk rather than increase it (Miller & Bromiley, 1990; Miller & Chen, 2004). Likewise, Bromiley and Washburn (2011) argue that poorly performing firms avoid increasing risks by searching preferably in domains for solutions that involve less additional risks, such as cost cutting.

To reconcile these perspectives, studies have argued that firms do not direct their attention to a single reference point. Rather, firms switch their focus between the performance aspiration level and the survival point depending on contextual factors (e.g., Audia & Greve, 2006; Hu, Blettner, & Bettis, 2011). For instance, using individual level data from the TV game show *Jeopardy!*, Boyle and Shapira (2012) find that followers falling behind the competition pay more attention to survival than do leaders. Leaders, in contrast, tend to focus on performance aspirations and take greater risks to maintain their leadership positions. Ferrier, Fhionnlaoich, Smith, and Grimm (2002) show that competition-buffering industry conditions (high entry barriers, concentration, and industry growth rates) may also influence attention across reference points in a manner that induces firms to pay more attention to performance aspirations relative to the need for survival and, consequently, to be more risk-seeking in their competitive actions (e.g., pricing, marketing, and inventory).

There are, in our view, three sets of difficulties in interpreting evidence on the relation between a performance shortfall and risk. First, risk as an outcome of problemistic search may result because the content of change is risky, but also because the process of changing is itself risky (e.g., Levinthal & Posen, 2007). Acquisitions, particularly large ones, are not only inherently risky investments, but also induce risk because they disrupt organizational routines and practices. Incremental adaptations to existing practices (Massini et al., 2005; Schwab, 2007) may



not be risk inducing in content or process. From a content perspective, R&D may involve higher variance in outcomes than other types of investments, but to the extent that R&D is somewhat isolated from the day-to-day activities of the firm, investment in R&D itself may be less likely to disrupt organizational routines. Moreover, while most studies view engaging in organizational change as risky, Klingebiel (2017) argues that the decision not to change also entails risk, particularly in terms of failing to adapt to new situations.

Second, in empirical studies, change is difficult to disentangle from risk taking. For example, increases in R&D intensity or R&D spending are frequently used as proxies for risk taking (e.g., Barker & Mueller, 2002; Chen & Miller, 2007; Devers, McNamara, Wiseman, & Arrfelt, 2008; Hoskisson, Hitt, & Hill, 1993; Miller & Bromiley, 1990). However, such measures may be poor indicators of risk taking. Bromiley, Rau, and Zhang (2017) show that R&D spending lacks a clear connection with measures of organizational risk, and McAlister, Srinivasan, and Kim (2007) argue that R&D expenditures will create intangible assets that buffer risks in the market.

Finally, recent work by Kacperczyk et al. (2015: 229) suggests that change and risk taking “arise under different conditions and reflect distinct causal processes.” They posit that change results from problemistic search, a firm level response. In contrast, risk taking functions in accordance with loss aversion, an individual level phenomenon described in prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992). They find that a performance shortfall from internal social comparison across units within a firm induces individual level concerns and, subsequently, increases risk taking, whereas a performance shortfall relative to competing firms in the external reference group is a firm level issue that leads to change.

In sum, although extant research on the behavioral consequences of problemistic search is extensive, there are substantial gaps in our understanding. Important questions remain to be addressed, both in terms of the direction of search for how a particular type of performance shortfall maps to search in a particular domain (e.g., when an ROA shortfall leads to change in R&D rather than an acquisition), and the nature of risk taking and change as a response to a performance shortfall.

## **2.6. Stopping Mechanisms of Problemistic Search**

Cyert and March (1963: 121) argue that “problemistic search is stimulated by a problem [and] depressed by a problem solution.” In this viewpoint, a solution indicates the implementation of a change that restores performance above the aspiration level. Stopping is inherently driven by satisficing (Simon, 1956); the first change that resolves the performance shortfall is sufficient to cause search to stop.

In considering problemistic search from a process perspective, understanding the mechanisms underlying the stopping of search is as important as understanding the mechanisms underlying the triggering of search. However, while triggering mechanisms are subject to substantial scholarly work, per our earlier discussion, stopping mechanisms have received much less theoretical and empirical attention. Our discussion below highlights three broad mechanisms that may lead to stopping: performance improvement, aspiration degradation, and attentional shifts. Empirical evidence is limited for these mechanisms; we can only draw inferences indirectly from work on the triggering of search. Yet Greve (1999: 606) argues, “Success breeds complacency more quickly than failure spurs action.” Thus, starting and stopping of search need

not be symmetric. Table 5 summarizes key arguments regarding the stopping mechanisms of problemistic search and lists selected example studies.

<< Insert Table 5 here >>

#### *2.6.1. Performance improvement*

In Cyert and March's (1963) conceptualization of problemistic search, the most basic mechanism that inhibits further search is performance improvement from below an aspiration to above it. March (1994: 28) notes "failure increases search, and success decreases search. [...] search continues as long as achievement is below the target and ends when the target is exceeded."

While the underlying logic is simple and compelling, this stopping mechanism has received only limited empirical evaluation. One notable exception that directly tests stopping, Caplin, Dean, and Martin (2011), does so at the individual rather than organizational level of analysis. In a series of choice experiments, they find "broad support" for Simon's (1955) satisficing hypothesis that individuals search sequentially for a satisfactory alternative, and stop searching when they sample an alternative that exceeds their aspiration.

In an organizational context, however, evidence is circumstantial. Some insight into the implications of performance improvement for the stopping of problemistic search may nonetheless be derived indirectly by combining the direct evidence on two related ideas: (1) problemistic search leads to performance improvement, and (2) higher performing organizations engage in less (or no) problemistic search. In support of the first argument, studies investigate the performance consequences of problemistic search (e.g., Audia et al., 2000; Bromiley, 1991; Miller & Leiblein, 1996; Posen & Chen, 2013; Wiseman & Bromiley, 1996) and generally find

support for the idea that problemistic search improves subsequent performance. A small set of studies is more skeptical about the performance consequences of problemistic search, finding, for instance, reversion to the mean (Greve, 1999) or performance decline in some instances (Oliva & Sterman, 2001). In support of the second argument, several empirical studies suggest that higher performing firms engage in less problemistic search but the evidence is mostly indirect because it focuses on the effect of higher performance on triggering (additional) search rather than on the actual cessation of search (e.g., Fiegenbaum, 1990; Gaba & Bhattacharya, 2012; Greve, 1998; Greve, 2007; Park, 2007).

The theoretical arguments underlying stopping, and the circumstantial evidence highlighted above, contrast with the predictions of other theories. For instance, momentum theory suggests that search and change continue, once initiated, even if the performance shortfall is resolved. Momentum theory has received empirical support in the domains of acquisitions (e.g., Amburgey & Miner, 1992; Baum, Li, & Usher, 2000), alliances (Park, Martin, Lee, & Mezias, 2017), and organizational change (see Beck, Brüderl, & Woywode, 2008 for a review). This need not imply that satisficing does not function in problemistic search. Rather, stopping may be attenuated by momentum such that search may continue for a period of time, even though the aspiration level has been attained, which leaves open the question of when momentum impacts problemistic search. It is conceivable that, while problemistic search ceases upon reaching the performance threshold, as predicted by problemistic search theory, other search processes such as slack search and institutionalized search start or continue. In other words, the organization may continue to search because it switches to a different learning process (Winter, 2000).

### 2.6.2. *Aspiration degradation*

While our discussion of performance improvement assumes that the organization uses the same aspiration for starting and stopping, in some situations, an organization may exert substantial effort in problemistic search without identifying a solution that can restore performance to an acceptable level. In that situation a firm may adjust the aspiration downward, instead of continuing search for a solution that meets the initial aspiration level (Cyert & March, 1963). March (1994: 31) notes “aspirations change over time, and they change endogenously,” and “when performance is below the target, ... the target is lowered.” From this perspective, it is possible that problemistic search stops without any performance increase if sufficient aspiration degradation takes place.

Only indirect evidence is available to support the claim that a repeated inability of search to identify a satisfactory solution inhibits subsequent search via aspiration degradation. For instance, a body of research empirically examines aspiration adaptation relative to past experience, finding that decreasing historical performance leads to decreasing aspirations. Some studies (e.g., Greve, 2002; Lant, 1992; Mezias et al., 2002) show evidence that organizations adapt their aspirations downward over time when the organization experiences repeated performance shortfalls. Combined with evidence that suggests that search depends upon performance below aspirations, we can conclude that search should cease once aspirations have adapted downwards by a sufficient amount.

Our current conclusions about aspiration degradation are based on extrapolating findings regarding the triggering of search to the domain of stopping of search. A more convincing test of aspiration degradation as a stopping mechanism requires a more process-oriented perspective,

with a study following a cycle of sequential search and change activities that fail to meet performance before the search cycle eventually terminates.

### *2.6.3. Attentional shifts*

The behavioral theory of the firm points to another mechanism through which search may be stopped — the transition of managerial attention. As we discussed earlier, managers' attention may shift between different reference points (e.g., Audia & Greve, 2006; Blettner et al., 2015; Desai, 2008; Greve, 2010; Iyer & Miller, 2008; Joseph & Gaba, 2015; Lehman & Hahn, 2012; Lehman et al., 2011; Miller & Chen, 2004; Ref & Shapira, 2017), different aspirations (e.g., Bromiley, 1991; Deephouse & Wiseman, 2000; Blettner et al., 2015), and different goals (e.g., Gaba & Joseph, 2013; Greve, 2008a; Vissa et al., 2010). An attentional shift to a different objective may cause a firm to stop searching for a solution to solve the previously attended problem. If decision makers' attention is relocated to a different goal, the performance shortfall that triggered search in the past might cease to operate as a driver of problemistic search.

To our knowledge, no systematic quantitative research has tested the direct effect of attention shifts on the stopping of search (see March & Olsen, 1976, for a qualitative description of the issue). However, indirect support for this idea can be derived from the effects of shifts in attention on the triggering of search and the intensity of search, which we discuss in the respective sections, and some qualitative work provides supporting evidence. However, additional research is needed to test if the arguments regarding attention extend to stopping search.

Taken together, the extant literature on the stopping of problemistic search is limited. While the main theoretical arguments are compelling, there is little direct empirical evidence, which reflects a substantial shortcoming in our understanding of problemistic search. Moreover,

potential asymmetries between starting and stopping search suggest that research must begin to study problemistic search from a process perspective.

### **3. TOWARD A RESEARCH AGENDA - RENEWING PROBLEMISTIC SEARCH THEORY**

Our review of the extant literature examines problemistic search from a process perspective. In this section, our objective is twofold. We begin by summarizing critical issues we identified in our literature review. The issues we highlight are, in particular, related to the current theoretical conceptualization. We then proceed to suggest a research agenda to address these issues to revitalize research and enable further progress in our understanding of how firms respond to performance feedback.

#### **3.1. Issues in the Extant Literature**

In our review of the literature, we make salient several issues related to the conceptualization of problemistic search that, we believe, have held back theoretical and empirical progress. We identify six key issues. While we discuss these issues independently, they are integrally related and cut across all stages of the process of problemistic search. Figure 2 lists these issues, and highlights their primary loci of influence.

<< Insert Figure 2 here >>

First, and perhaps most important, the traditional conceptualization of problemistic search assumes a *high degree of automaticity in firms' response to performance feedback and an overly routinized process of search*. This is not surprising given problemistic search's roots in the

behavioral theory of the firm — the automaticity in the theory reflects a purposeful, parsimonious, polar opposite rebuttal to the overly rationalistic micro-economic conceptualization of organizations in the early 1960s. Yet automaticity may be equally unrealistic as an assumption for organizational behavior in response to performance feedback. A number of reasons underlie this observation. Performance feedback itself, or the evaluation of performance feedback, is likely to be ambiguous (Greve & Gaba, 2017; March & Olsen, 1976; Posen & Levinthal, 2012; Rerup, 2006), the salient aspiration against which performance is measured may itself differ across units and coalitions within the organization (e.g., Gaba & Joseph, 2013; Desai, 2016b). Moreover, rather than resulting from automatic decision-making, important “decisions often result from *deliberate* attempts to anticipate future environments” (Gavetti, Greve, Levinthal, & Ocasio, 2012: 9).<sup>4</sup> Feldman and Pentland (2003) make a similar argument in the context of routines, arguing that the routinized view of organizational behavior emerging from the Carnegie School over-emphasizes the structural aspects of behavior. Indeed, routinized behaviors may emerge from agentic, cognitively rich, learning behavior that is adaptive in response to the environment (Aggarwal, Posen, & Workiewicz, 2017).

Second, the traditional conceptualization of problemistic search tends to *focus primarily on solution search* (Cyert & March, 1963). Implicit in a narrow focus on solution search are at least one of two assumptions: On the one hand, a performance shortfall relative to an aspiration has a clear mapping to a particular latent problem, or the problem is sufficiently well-structured that solution search is likely to be effective without further consideration of the problem (Von Hippel & Tyre, 1995). On the other hand, cognition is so limited that a firm must blindly look for solutions without meaningful consideration of the underlying problem. While one or both

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<sup>4</sup> *Emphasis added.*



assumptions may sometimes be valid, a large body of research on managerial problem-solving argues for, and provides evidence that firms indeed engage in a cognitively intensive process of problem definition (Joseph & Wilson, 2017; Lyles, 1981; Mintzberg, Raisinghani, & Théorêt, 1976; Nutt, 1993), and makes compelling claims about the centrality of problem definition in the context of strategy making (Nickerson & Zenger, 2004; Nickerson, Yen, & Mahoney, 2012). Yet to date, the process and challenges associated with defining or discovering the problem have been broadly overlooked in the literature on problemistic search.

Third, the extant problemistic search *literature tends to conjoin distinct elements of the problemistic search process*: triggering search, behavioral consequences of search, and stopping search. While the original conceptualization of problemistic search defines these as distinct elements of the process, the empirical literature is constrained in a manner that makes distinguishing these elements challenging. Data is often available in the form of performance relative to some inferred aspiration, and change on some observable dimensions (e.g., acquisitions). When we observe a correlation between performance shortfalls and acquisitions, what are we really observing? Are we observing a series of acquisitions that together reflect the process of search? Or, is each observed acquisition the final outcome of a distinct search process that might have included unobserved efforts at cost reduction and marketing increases that failed to restore performance? Because of these challenges, we have remarkably little evidence to support theoretical claims about the process of problemistic search, and indeed, conjoining search stages may be part of the challenge underlying the mixed empirical results on the triggering of problemistic search.

Fourth, the standard conceptualization of problemistic search focuses on its myopic nature, and as a consequence, the literature tends to consider it *primarily as a driver of*

*exploitation*. Levinthal and March (1981: 309), argue that problemistic search “emphasizes relatively immediate refinements in the existing technology, greater efficiency, and discoveries in the near neighborhood of the present activities.” The exploitation focus of problemistic search is predicated on the assumption, common across much work in the Carnegie tradition, of limited managerial cognition. The limited-cognition assumption is often relaxed in more recent work on search (e.g., Gavetti & Levinthal, 2000; Posen & Levinthal, 2012). Moreover, the exploitation focus seems somewhat at odds with the broad variety of behaviors the extant literature predicts, including R&D and risk taking, which may be much more exploratory; the broader literature on search has begun to emphasize a variety of mechanisms to extend search beyond the vicinity of existing knowledge, routines, and activities (Laursen, 2012).

Fifth, the conceptualization of problemistic search that assumes an almost mechanistic link between performance shortfalls and search *conflicts with predictions made by other theories* that also receive empirical support. Greve (2010: 109) cautions that “performance feedback is a component of the organization’s adaptation system but cannot be the entire system.” With respect to the triggering of problemistic search, consider escalation of commitment theory (e.g., Sleesman, Conlon, McNamara, & Miles, 2012; Staw, 1976) and threat rigidity theory (Chen & Miller, 2007; D’Aunno & Sutton, 1992; Shimizu, 2007; Staw et al., 1981). With respect to stopping of problemistic search, consider momentum theory (Amburgey & Miner, 1992; Kelly & Amburgey, 1991; Miller & Friesen, 1980), which argues that firms tend to repeat the same activity largely independent of performance feedback or despite negative performance feedback. Thus, once triggered, search may not cease when the triggering performance shortfall is resolved.

Finally, problemistic search is typically conceptualized as having a *narrowly delineated outcome* — organizational change that restores performance above aspirations (Greve, 2003c).

Yet a diverse array of research on search processes suggest that they engender unintended byproducts. Many prominent examples of ancillary outputs of search are in the domain of innovation (e.g., Cohen & Levinthal, 1994; Miner et al., 2001; Mintzberg & McHugh, 1985). Extant theory on problemistic search does not deny the existence of these ancillary outputs, but neither can it systematically account for them. In part, the challenge is that leveraging these ancillary outputs of search requires richer cognitive assumptions that facilitate their storage, retrieval, and application. As a result, we have a limited understanding of the factors that allow an organization to leverage ancillary outputs from problemistic search while solving the triggering problem.

### **3.2. Process Theorizing and Cognition — Overarching Concepts in our Research Agenda**

There are two overarching concepts in the research agenda we propose. Theorizing must take a *process approach* that embraces the temporally unfolding nature of problemistic search, and it must embody a more central *role for cognition* than that suggested by the traditional conceptualization.

Research on problemistic search has taken a variance theorizing approach (Mohr, 1982). It is somewhat static in nature, focusing on covariation between, for example, a performance shortfall and behavioral change. Greve and Gaba (2017) conclude that the “middle step of problemistic search has seen much less investigation than work simply linking performance to organizational change or risk change.”

Thus, the literature tends to treat the specific internal (sub)processes of problemistic search as a black box, without directly observing or measuring the process inside. Hiding in that black box is the unfolding and potentially recursive stages of problemistic search. These stages

involve the: (i) recognition of a performance shortfall relative to an aspiration, (ii) process of sequentially searching for change alternatives that will resolve the shortfall, including the locus and direction of search and the means of evaluating alternatives, and (iii) mechanisms that stop search. While blackboxing the process facilitates empirical research, further progress to understand the mechanisms of problemistic search requires a decidedly different perspective. A process perspective, which addresses “questions about how and why things emerge, develop, grow, or terminate over time” (Langley, Smallman, Tsoukas, & Van de Ven, 2013: 1), forces us to open up the black box to investigate how problemistic search is carried out in organizations. This process research, independent of whether qualitative or quantitative, would need to investigate the detailed tasks at different stages of the process and their interconnections and recursions over time thereby complementing the largely static perspective of variance theories.

We believe that progress in the literature will also be facilitated by relaxing some of the simplified organizational apparatus and the constraints imposed by the initial conceptualization of problemistic search in Cyert and March (1963). As we pointed out earlier, recent research in the Carnegie School has made important strides by adding back a modicum of managerial cognition to models of problemistic search, reinstating a critical part of the Carnegie School research agenda (e.g., in March & Simon, 1958) underrepresented in the modern literature. Porac and Tschang (2013) go further, arguing that it is time to do away with the small brains image of managers. Relaxing this assumption allows us to recognize that managers may have substantial latitude in their actions even in routinized settings (Feldman & Pentland, 2003), and that these actions are underpinned by cognitive processes, at both the managerial and the organizational level (e.g., Walsh, 1995). Gavetti and Levinthal (2000: 113-133) describe cognition as “a forward-looking form of intelligence that is premised on an actor’s beliefs about the linkage

between the choice of actions and the subsequent impact of those actions on outcomes. Such beliefs derive from the actor's mental model of the world (Holland, Holyoak, Nisbett, & Thagard, 1986).”

By attending to cognition, we do not imply the need for, or development of, an individual level, psychological theory of problemistic search. Rather, we propose an eclectic approach, which allows organizational information processing to draw upon managerial cognition, just as Feldman and Pentland (2003) propose individual agency plays an important role in organizational routines. This use of cognition at the macro level is increasingly widespread in work in the Carnegie tradition. For instance, the merit of recent work on microfoundations (Barney & Felin, 2013; Felin, Foss, & Ployhart, 2015; Foss & Pedersen, 2016; Winter, 2013) “resides not in studying individuals’ behaviors per se, but rather from identifying how individual behaviors interact and aggregate to generate macro-level phenomena” (Aggarwal et al., 2017: 1213).

As we consider a theoretical role for actors capable of more complex cognitive tasks and move towards a richer process view of problemistic search we see issues, but more important, we see opportunities to advance the understanding of problemistic search. These opportunities are reflected at multiple points in the process model, across the range of identifying a problem, to triggering search, behavioral consequences, and stopping search.

In the following sections, we argue that a process approach that takes cognition seriously will lead to a more complete understanding of problemistic search. We begin by arguing that taking a process approach may enable research to disentangle the stages of problemistic search that have often been conjoined in the extant literature. Then we discuss the possibility that the current process model of problemistic search, which focusses on solution search, under-accounts

for the search for problem definitions. We will argue this problem definition search may involve a greater cognitive component than solution search, and the outcome of problem definition search itself serves as a cognitive representation of the space of alternative solutions. Next, we discuss how adding cognition, together with taking a process perspective, may inform research regarding the locus of problemistic search, and may enable problemistic search theory to incorporate explanations for alternative behaviors related to triggering and stopping search not predicted by the overly mechanistic model. We conclude by examining how a more cognitive approach to problemistic search facilitates endogenizing the creation and utilization of ancillary outputs from search into our process model of problemistic search.

### **3.3. Disentangling the Stages of Problemistic Search**

A deeper understanding of problemistic search requires disentangling the distinct elements of the process, that is the triggering of search, search, behavioral consequences of search, and the stopping of search. As we noted earlier, these elements are often confounded in empirical research with a design that treats search as a black box, focusing on the covariation between a performance shortfall relative to an aspiration and an observed outcome in the form of a change that seeks to restore performance. We believe that fruitful research opportunities, both theoretical and empirical, will result from opening this black box to disentangle the stages of search. Doing so may shed light on why the literature has produced mixed empirical results on triggering problemistic search.

A critical step to disentangle the stages of problemistic search is the need to theorize and empirically examine assumptions about cognition in the problemistic search process, particularly with respect to how alternative solutions are evaluated. Our literature review highlights two polar cases, cognitively demanding offline evaluation or cognitively easy online evaluation (Gavetti &

Levinthal, 2000). The interpretation of empirical studies of problemistic search differ depending on the assumption about the nature of alternative evaluation. Take for example divestitures; they may be the behavioral consequence of an offline search process in which the organization considered a variety of alternative courses of action and finally chose a divestiture as the first encountered course of action that has the potential to restore performance. In this case, the process of search is unobserved, except for the solution alternative (i.e., the divestiture) that was evaluated positively and causes search to stop. The divestiture may also be viewed as a single instance of online search with an uncertain outcome, and as such, the organization may need to engage in several other actions to mend the performance shortfall. If the observed divestiture does not mend the performance shortfall, the firm will engage in other changes (e.g., alliances, restructuring, acquisitions) to mend the performance shortfall. In this interpretation, divestitures may not necessarily be associated with stopping search.

It seems likely that organizations use a mix of offline and online evaluation, and thus, the changes we observe in empirical studies are ambiguous as a representation of search. Research that is designed to disambiguate the process of search from its outcome in terms of observed change may aid in addressing the mixed empirical findings on the threshold function of aspirations triggering problemistic search. That is, the mixed results may reflect ongoing search with offline evaluation that did not result in organizational change, or search that led to a behavioral response not tracked in the study.

Given that prior research confounds search with its outcome in terms of a change that restores performance, disentangling the stages of problemistic search may also facilitate much-needed progress in empirically distinguishing problemistic search from other types of search processes. The conceptualization of problemistic search is built on the idea that search

ceases once performance has been restored. In contrast, slack search or institutionalized search, two alternative types of search processes developed within the behavioral theory of the firm (Chen & Miller, 2007; Cyert & March, 1963; Greve, 2003c), start or continue when performance is above aspiration. Specifically, problemistic search is triggered by, and focuses on a single objective related to the focal problem, and it is typically assumed to be somewhat exploitative. In contrast, institutionalized and slack search occur independently of specific problem triggers, and slack search is generally assumed to be more exploratory. When observing performance below aspirations, empirical research often is unable to distinguish if the organization is engaging in problemistic search, institutionalized search, or both. When observing performance above aspirations, the situation is even more challenging, because it is often impossible to distinguish whether problemistic search continues, or institutionalized search takes place, or the organization has commenced slack search. Moreover, disentangling the stages of problemistic search may facilitate research that is more capable of distinguishing between different types of search (e.g. institutional search, slack search).

Disentangling the stages of problemistic search points to several additional research opportunities. The importance of offline search implied in our argument suggests the need for in-depth research on how organizations search for alternative solutions. How are alternatives generated? How are they evaluated? Another research opportunity lies in the directionality of organizational change in response to performance below aspiration. Because the literature does not disentangle the different stages of problemistic search, current empirical efforts are unable to identify if different responses to a performance shortfall (e.g., alliances, R&D investment) reflect ongoing search in different directions, or if they reflect the outcomes of different offline search processes. It seems reasonable to suggest that attentional structures and cognitive biases may also



influence the directionality of search and the alternatives chosen from search. While some research points to contingencies that may shape the directionality of search (Kuusela et al., 2017), our understanding of the factors that may shape search direction is in its infancy.

### **3.4. Extending the Process Model of Problemistic Search**

A potentially important component of the process of problemistic search, unaddressed by the current conceptualization, is that a firm is not presented with a problem, as existing research assumes, but rather, it is presented with a symptom of a latent problem—performance below aspiration.

Problem definition is the process of causal diagnosis of the performance shortfall. The distinction between symptom and problem is best explained with the help of an example: Consider a patient, suffering from chest pain, who seeks medical treatment. The doctor's first step is not to search for a treatment (solution), but rather to diagnose the underlying condition — that is, define the problem (e.g., indigestion, heart disease), because suitable treatment will differ across problems. While the search for a solution can, in some instances, commence without rich consideration of the underlying problem, it seems self evident that this need not be the case. An organization facing a performance shortfall in profitability does not search among potential solutions, such as the acquisition of a rival, development of new products, or hiring a new CEO, without first seeking to identify the latent problem. Organizations can and do engage in mindful, cognitively intensive, efforts to define the problem. However, the conditions under which problem definition is necessary remains the subject of debate (von Hippel & von Krogh, 2016), and the prevalence of problem definition in the context of problemistic search is unknown.

We are not the first to point to the important role of problem definition. Einstein famously argued, “[t]he formulation of a problem is often more essential than its solution” (Einstein & Infeld, 1938: 92). Problem definition is not absent in management theory. Most notable is the recent body of strategy research that argues for the centrality of managerial action oriented toward the identification of high value problems (Nickerson & Zenger, 2004; Nickerson et al., 2012). Like problemistic search itself, this work is built on a theoretical foundation of bounded rationality. An older body of research, focusing on decision-making by top executives, reflects a similar argument about the importance of problem-solving in organizations, although this work has not been integrated into research on problemistic search (Kilmann & Mitroff, 1979; Lyles, 1981; Mintzberg et al., 1976; Nutt, 1993; Ramaprasad & Mitroff, 1984; Simon, 1978a; Smith, 1988; Smith, 1989). For example, Mintzberg et al. (1976: 274) argue that problem definition, which they refer to as problem diagnosis, “is probably the single most important routine, since it determines in large part, however implicitly, the subsequent course of action.” Even Cyert and March (1963: 121) highlight a very simple model of problem definition that recognizes the distinction between symptoms and problems noting a firm may “search in the neighborhood of the problem symptom”—although their brief discussion is largely overlooked in the extant literature that focuses on solution search.

We believe that a behaviorally realistic approach to considering the role of problem definition is to reconceptualize the problemistic search process as consisting of two distinct search stages. A performance shortfall acts as a symptom that triggers problem definition search. At the conclusion of this first stage, the second stage of search commences; solution search terminates when the performance shortfall is resolved. This process need not be fully linear, as there may be

interactions between problem definition and solution search. Moreover, they may be conditions under which the problem definition search stage is bypassed.

To the extent we conceive of problem definition activities as a process of search governed, in the usual Carnegie School manner, by bounded rationality and satisficing, then research is needed to understand the nature of satisficing in the problem definition search stage of the process (i.e., aspirations and stopping rules), and how they adapt with experience.

A theoretically simple approach would consider low-cognition online evaluation (Gavetti & Levinthal, 2000) in problem definition search—each problem definition candidate is directly tested by engaging in solution search. This is consistent with Cyert and March's (1963: 122) example, "if the problem is the failure to attain the sales goal, the search begins in the sales department and with the sales program. Failing there, it might reasonably proceed to the problem of price and product quality and then to production costs." That is, each potential problem definition is tested directly through the commencement of solution search, and only when solution search fails to find a satisfactory solution does the firm return to problem definition search, cycling through the two search processes until the performance shortfall is resolved.

An alternative approach is to consider offline evaluation, which requires assumptions about cognitively more capable managers. Following the general search logic articulated by Gavetti and Levinthal (2000: 115) in the context of solution search, a firm may evaluate alternative problem definitions using, for example, their "simplified cognitive representation" in the form of their "understanding of the world and the probable consequences of engaging in the proposed behavior." Only after a sufficiently good problem definition is identified would the firm undertake solution search. How such satisficing functions in the context of offline problem definition search is an open question. One potential approach worth considering is a

“comprehensiveness aspiration” defined as the “extent to which alternative, relevant problem formulations are identified with respect to an initial symptom or web of symptoms” (Baer, Dirks, & Nickerson, 2013: 199). The problem definition aspiration may be associated with the number of potential problem definitions evaluated offline, before the one considered best amongst this set is put into action with the start of solution search.

The extent to which problem definition search occurs in the context of problemistic search is an important open empirical question. There are also many open theoretical questions. Under what conditions is problem definition search present or absent? How is the evaluation of problem definition candidates undertaken? On what basis does the organization satisfice in problem definition search? Substantial research opportunities exist to answer these and other related questions.

### **3.5. Rethinking the Locus of Problemistic Search**

The conceptualization of problemistic search as myopic and largely exploitative (e.g., Cyert & March, 1963; Levinthal & March, 1981) is somewhat at odds with the view of problemistic search as a “‘master switch’ that controls a range of organizational responses to problems” (Greve, 2003c: 76). Firms may respond to performance shortfalls in alternative ways, such as by exploring rather than exploiting. Reconciling these views is a potentially fruitful direction for future research. Specifically, we believe that introducing problem definition search may enable a deeper understanding of the conditions under which problemistic search is exploratory rather than exploitative, provide opportunities to think differently about the concept of distance in problemistic search, and introduce novel insights into how organizations balance exploration and exploitation.

Extant research recognizes that problemistic search can give rise to exploration (see Laursen, 2012 for a recent discussion); it typically does so by suggesting that search starts locally, and extends in breadth only if local alternatives are unable to resolve the performance shortfall. This view, however, is predicated on two key assumptions: managers and firms have limited cognitive capacity, and problemistic search occurs without any substantive effort at problem definition. Relaxing these assumptions may open alternative avenues to understand the locus of search.

Problemistic search may be more exploratory in the space of potential solutions if the organization has a mental representation of the environment that facilitates more distant search (Gavetti & Levinthal, 2000). One critical question relates to the source of these representations. A mental representation may be exogenous to the current problemistic search event, for example, from prior experience with related performance deficits or from analogy (Gavetti, Levinthal, & Rivkin, 2005). We believe, however, that mental representations of the solution landscape may also be endogenous to the process of problemistic search. In particular, our extended process model suggests a potentially promising line of research would involve understanding how a problem definition, which results from first-stage problem-definition search, functions as a mental representation of the space over which solution search occurs.

Understood as a causal diagnosis of the performance shortfall, the problem definition identifies the elements (causes and their effects) that constitute the underlying problem, the relationships among these elements, and how these selections may impact solution search (Smith, 1989). In this view, a problem definition has many features of a mental representation (e.g., Barr, Stimpert, & Huff, 1992; Gavetti & Levinthal, 2000; Kiesler & Sproull, 1982) that enables

predictions about reality (Holland, Holyoak, Nisbett, & Thagard, 1986) and can guide solution search. Problem definitions can take several forms. For instance, they may take the form of a lower dimensional map of the space of possible solutions, guiding the organization to start search in more attractive regions of the solution space (Gavetti & Levinthal, 2000). They may also take the form of a representation of the problem structure thereby identifying high-potential directions for local search, bounding the range of solutions considered during solution search by ruling out solutions inconsistent with the problem definition. Indeed, Csaszar and Levinthal's (2016) recent two-stage model of search can be interpreted in a manner consistent with this logic.

A potentially promising avenue of research would be to understand under what conditions overt problem definition search occurs, and to understand how the process and outcome of problem definition search influences the locus of solution search. This conceptualization of the role of the problem definition, as an outcome of problem definition search, implies solution search behavior that may be quite different from the simple local solution search in the behavioral theory of the firm. For instance, a problem definition that rules out the space of solutions local to currently employed activities will engender broader exploration. Indeed, distant solution search may precede local search when problem definition search identifies a relatively narrowly defined location in the solution search space that is distant from the current position (existing routines and solutions) of the firm.

The distinction between problem definition search and solution search also stimulates novel questions about the dimensionality of distance in problemistic search. Cyert and March (1963) define localness based upon the distance of search from the problem symptom and from current activities (prior solutions). While the subsequent literature is not fully explicit, it seems to us that it typically focuses on distance from current solutions (e.g., Katila & Ahuja, 2002). In his

seminal study on exploration and exploitation, March (1991: 71) defines exploitation to include “things captured by terms such as refinement, choice, production, efficiency, selection, implementation, execution,” and exploration to include things such as “search, variation, risk taking, experimentation, play, flexibility, discovery, innovation.” The extant literature tends to think of these “things” in terms of solution search, because solutions are a more tangible realization of the more intangible and often latent problem they solve.

Taking the problem and problem definition search as the starting point, we consider organizational action as exploratory, not on the basis of solution novelty, but rather, on the basis of the novelty of the problem definition (i.e., its distance from prior problem definitions). A recent body of work argues that the “problem” is a critical unit of analysis (Nickerson & Zenger, 2004; Nickerson et al., 2012). Extending this logic, a central dimension of novelty in organizations reflects the novelty of the problem being solved. Ahuja and Katila (2004), for example, argue that local solution search based on “idiosyncratic” problems may lead to resource heterogeneity. Thus, an organization that allocates attention and effort to solving local problems generates less novelty on the problem-dimension than an organization that seeks to solve distant problems.

Distinguishing between problem distance and solution distance may allow us to gain insight into how, in the context of problemistic search, organizations manage the balance between exploration and exploitation to achieve ambidexterity (Tushman & O'Reilly, 1996; Lavie et al., 2010). Specifically, separating exploration and exploitation in problemistic search based on problem novelty and solution novelty may allow for different forms of ambidexterity. Solutions may be local or distant, and problems might be too. Thus, we might observe forms of ambidexterity that balance exploration and exploitation across problem-solution pairs. For example, a firm may explore during problem definition search, but exploit during solution search,

or vice versa. This type of ambidexterity may have distinct advantages because combining existing solution knowledge with novel problems, or vice versa, may pose lower cognitive demands upon the organization than exploring on both dimensions, and may have the potential to solve more challenging problems or create more novelty than exploiting on both dimensions. However, this form of ambidexterity may pose unique challenges and tensions. For instance, when the organization tries to explore very different solutions with an existing problem definition, solution search and organizational change may be hampered if the existing problem definition has become mirrored in organizational structures, as suggested in the organizational mirroring hypothesis (Henderson & Clark, 1990) and such organizational structures may be incompatible with very novel solutions.

In sum, integrating problem definitions search into the model of problemistic search, and conceptualizing the problem definition as a mental representation of the space of solutions, we open up a wide variety of research opportunities related to the locus of problemistic search and the way exploration and exploitation may be balanced in undertaking problemistic search.

### **3.6. Integrating Alternative Behaviors to Problemistic Search**

When do organizations respond to a performance shortfall with behaviors other than search for solutions? Problemistic search theory suggests a rather mechanistic link between a performance shortfall and subsequent search, and thus, this question has historically been outside the domain of research on problemistic search. However, other theories make quite different predictions, both in terms of starting of search after the recognition of a performance shortfall, and stopping search when a solution is found. We believe that research seeking to address these discrepancies, either by identifying contingencies or by substantively integrating their seemingly



contradictory predictions, may add substantially to our understanding of organizational responses to performance feedback.

At least two theories make predictions that oppose those associated with triggering problemistic search. Escalation of commitment theory (e.g., Staw, 1976; Sleesman et al., 2012) indicates that organizations may intensify their commitment to the current course of action when performance below aspiration leads to perceived identity threats (Brockner, Houser, Birnbaum, Lloyd, Deitcher, Nathanson, & Rubin, 1986), threats to the perception of self-esteem (Zhang & Baumeister, 2006), or the need to self-justify behavior (Staw, 1976). Threat rigidity theory proposes that in the face of threats, which can be read to include performance shortfalls, organizations may restrict information processing, centralize, reduce costs, and constrict decision making (D'Aunno & Sutton, 1992; Staw et al., 1981). In both of these theories, instead of reacting to a performance shortfall by organizational change and risk taking as problemistic search theory would predict, firms may persevere and even intensify efforts in undertaking their current behaviors.

There are perhaps two approaches that research may take to address this conflict between theories. While one approach examines contingencies (i.e., Greve, 2010), a different approach recognizes that the theories conflicting with problemistic search come from the psychology literature, and thus a more cognitive approach to problemistic search may be required.

The contingency approach would seek to understand the conditions under which the mechanistic problemistic search theory or the psychological theories (threat rigidity and escalation of commitment) dominates. Such work may follow a well worn path, in the spirit of prior work, which has looked at contingency variables such as distance from bankruptcy,

organizational power concentration, top management diversity, firm size, age, and experience (Chattopadhyay, Glick, & Huber, 2001; Ferrier et al., 2002; March & Shapira, 1992; Sitkin & Pablo, 1992; Mone et al., 1998; Audia & Greve, 2006; Desai, 2008).

An alternative approach, which to us seems to have greater promise, integrates the psychological mechanisms underlying threat rigidity and escalation of commitment arguments into the conceptualization of problemistic search. That is, recognizing that aspirations and performance are often shrouded in ambiguity and subject to interpretation (March & Olsen, 1976), research must take seriously the cognitive component of recognizing a performance shortfall relative to aspirations. The limited efforts in this direction that currently exist (e.g., Audia & Brion, 2007; Jordan & Audia, 2012), clearly suggest that psychological factors such as self-enhancement may shape decision making related to problemistic search. Not only does this create boundary conditions for the occurrence of problemistic search, it also suggests that similar cognitive mechanisms may impact the locus and direction of search.

The extended process model we propose, which includes problem definition search and solution search, suggests that the point in the process at which escalation or threat rigidity act is, as yet, unknown. For instance, rigidity in the face of a performance shortfall may imply that problem definition search does not occur, or alternatively, conditional on the conclusion of problem definition search, solution search does not occur. Indeed, it seems plausible that the magnitude of the threat perceived by a firm may be related to the outcome of problem definition search. Managers' perception of the seriousness of the problem discovered via problem definition search determines if the threat is daunting or not, and thus, the extent of rigidity in terms of whether solution search occurs. The magnitude of the 'threat' may not be driven by the size of the performance shortfall, but rather, by the outcome of problem definition search.

Understanding and integrating these alternative responses to performance shortfalls, and the theoretical mechanisms that drive them, further points out the importance of characterizing the attentional and cognitive processes that regulate processing performance feedback relative to aspirations (e.g., Blettner et al., 2015; Chen & Miller, 2007; Jordan & Audia, 2012; March & Shapira, 1992). Recognizing the role of cognition in problemistic search may form a basis for deeper connections between the competing theories of responses to performance shortfalls. For instance, problem definition search as a cognitively intensive process may provide substantial latitude for managerial agency, and leaves ample room to integrate the largely psychological (and therefore cognitive) mechanisms, which underlie threat rigidity theory and escalation of commitment.

There is a similar need to integrate theory that makes alternative behavioral predictions regarding stopping search when a performance shortfall is resolved. As we noted in our review, the stopping prediction remains largely untested, and alternative predictions have been developed and tested in momentum theory (e.g., Miller & Friesen, 1980; Amburgey & Miner, 1992; Kelly & Amburgey, 1991). The contrasting predictions of problemistic search and momentum theory suggest mechanisms may exist that regulate when performance feedback is taken into consideration in stopping problemistic search. Recent work by Greve (2013), for example, proposes that an organization's ability to process performance feedback may play an important role. However, empirical research testing this cognitive argument, identifying contingencies that may shape stopping behavior, or substantively integrating momentum theory and problemistic search theory, are largely absent, and strikes us as an important area for future research.

### 3.7. Understanding the Ancillary Outputs of Problemistic Search

Extant research focuses on a single, narrowly delineated outcome of problemistic search—change that restores performance above aspirations (Greve, 2003c). Yet search processes, problemistic search included, oriented toward one objective often lead to ancillary outputs that may serve some very different objective (e.g., Cohen & Levinthal, 1994; Miner et al., 2001). In the context of problemistic search, these ancillary outputs are unused to solve the triggering problem, nevertheless may represent a significant source of potential value in future, unanticipated, or alternative contexts. Ancillary outputs may be problem definition candidates that did not explain the focal symptom, or solution candidates that did not solve the focal problem. For instance, the microwave oven was an unintended byproduct of defense contractor Raytheon's efforts to solve performance problems during the design of WWII radar systems. Similarly, pharmaceutical firms maintain libraries of molecules they have previously investigated, and search these molecule libraries for solutions to a given problem (Andriani, Ali & Mastrogiorgio, 2017).

Recognizing that problemistic search generates ancillary outputs raises important research questions. These questions relate to the mechanisms that regulate the unintended outputs of problemistic search, the ability of firms to identify valuable ancillary outputs and leverage them within the firm, and the mechanisms by which firms negate potentially harmful ancillary outputs. We believe that such research must acknowledge and allow for richer cognitive assumptions than are typical of much of the prior work on problemistic search in order to explain storage, retrieval, and application of these ancillary outputs.

To leverage problem definition and solution candidates that were not useful for the focal problem, the organization must notice their potential value and retain them for future use. Organizational attention in problemistic search is naturally oriented toward the focal output associated with solving the triggering problem, and therefore, ancillary outputs may go unnoticed, as suggested by research on attention and cognitive filtering (e.g., Fiol & Huff, 1992; Zajac & Bazerman, 1991). Moreover, research suggests that prior experience in a specific context may affect a firm's ability to understand the potential value of problem definitions and solutions in that context (Cohen & Levinthal, 1990; Gruber, Harhoff, & Hoisl, 2013). For instance, Shane (2000) shows that the application of a specific technology to a customer need is dependent upon an entrepreneur's educational background and industry experience. Research may investigate the organizational mechanisms and structures (Gaba & Joseph, 2013; Joseph, Klingebiel, & Wilson, 2016; Ocasio, 1997) needed to steer attention towards unused problem definitions and solution candidates.

An interesting possibility is that firms may be heterogeneous in their ability to capture ancillary value from problemistic search while achieving the focal value associated with solving the triggering problem. This heterogeneity may arise from differences across firms in the attentional and cognitive prerequisites to recognize and leverage these ancillary outputs. Not only may novelty arise from idiosyncratic situations, as Ahuja and Katila (2004) argue, but also from the ability to leverage ancillary outputs of problemistic search.

Research is also warranted into routines related to storage, transfer, adaptation, and integration of ancillary outputs that may be needed to capture value from unused problem definitions and unused solutions. Without storage and maintenance, problem definitions and

solutions may be forgotten or lost when personnel leave the firm (David & Brachet, 2011; de Holan & Phillips, 2004). Routines to transfer the unused problem definition and solution candidates to different locations in the organization may be required and may need to be designed to fit the characteristics of the knowledge underlying the problem or solution (Kogut & Zander, 1992). If unused problem definition and solution candidates are stored and transferred, routines may be necessary to adapt, integrate, and recombine the ancillary outputs to the new context (e.g., Jensen & Szulanski, 2004).

Finally, integrating ancillary outputs into theories of problemistic search also points to solution-driven search as a complementary process to problemistic search. Although the possibility of a search process that starts from an existing (potentially unused) solution and progresses towards identifying problems that the solution may fit is mentioned in the original work by Cyert and March (1963), and may be quite common in entrepreneurial contexts (e.g., Shane, 2000), it has not been incorporated into our understanding of problemistic search. Research into the features of solution-driven search seems warranted as it is likely to differ substantially from more traditional search processes that start with a problem and proceed to a solution. For instance, we have relatively little insight into the cognitive challenge of characterizing solutions before a problem is known. Moreover, to the extent the starting point for solution driven search may be an unused solution candidate from prior problemistic search, these two search processes may be integrally related. Consequently, research may benefit from comparing solution-driven search with the somewhat related concepts in the garbage can model (Cohen, March, & Olsen, 1972).

#### 4. CONCLUSIONS

In this article, we have reviewed the literature on problemistic search. Emerging from our review is a call for research on problemistic search that recognizes a more central role for cognition and a stronger emphasis on process theorizing.

The original conceptualization of problemistic search, like much of the conceptual toolkit in the foundational works in the Carnegie tradition (Cyert & March, 1963; March & Simon, 1958; Simon, 1947), emerged in response to the unrealistically rational view of organizations in classical economics. The simplicity in process, automaticity, and reliance on the assumption of bounded rationality in problemistic search theory provides not only a parsimonious theoretical foundation, but also a basis upon which a large and successful body of management research could emerge. However, over time this simplicity has become a limitation that obscures important elements of the process of problemistic search and limits the insight the theory can provide into managerial and organizational action.

Our review features opportunities for subsequent studies and highlights clear directions to renew the work on problemistic search. We believe that progress in the literature will be facilitated by extending some of the simplified organizational apparatus and by relaxing some of the constraints imposed by the initial conceptualization of problemistic search. In particular, we see the need for research to take a more process oriented approach and to embody a more central role for cognition than is suggested by the traditional conceptualization. As we described, much progress in the broader literature in the Carnegie tradition has been facilitated by adding a modicum of cognition to domains of the theory heretofore viewed as highly automatic. Indeed, cognition has already begun to seep into work on problemistic search via ideas such as attention.

The addition of a richer cognitive lens will surely go some way towards explaining the mixed empirical results on triggering problemistic search.

Our call for more process oriented theorizing reflects the observation that the literature has often been blackboxing the search process in the discussion of problemistic search, studying its antecedents and consequences without a rich connection to search itself. We believe that disentangling the stages of problemistic search, and recognizing the potential for a two stage search process, which includes not only solution search but also problem definition search (and theorizes about conditions when the latter occurs), are central to any reconceptualization of the theory of problemistic search.

To jumpstart a revitalized research agenda on problemistic search we identify several implications of addressing these central shortcomings. Through our renewed focus on process, the extension to the process model of problemistic search, and a renewed emphasis on cognition, we hope to maintain the relevance of problemistic search to theoretical and empirical research. We hope that future studies will be able to build on this renewed conceptualization.



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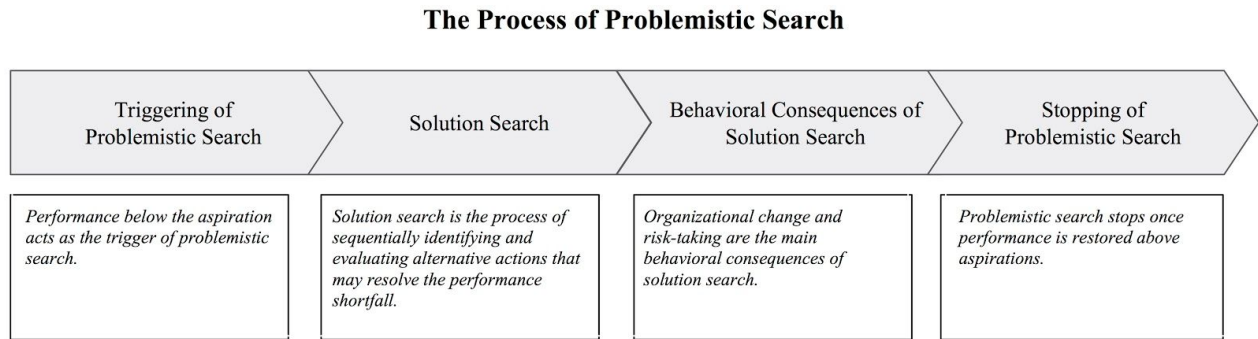


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## FIGURES

**Figure 1: The Process of Problemistic Search**



**Figure 2: Key Issues in Extant Research and their Primary Loci of Influence**

	Triggering of Problemistic Search	Solution Search	Behavioral Consequences of Solution Search	Stopping of Problemistic Search
<b>Extant research on problemistic search...</b>				
takes an overly routinized view with only a limited role for managerial cognition.	✓	✓	✓	✓
focuses on solution search overlooking behaviors intended to identify the latent problem underlying a performance shortfall.		✓		
conjoins distinct elements of the problemistic search process.		✓	✓	✓
assumes it is primarily a driver of exploitation, leaving underexamined its role in exploration.		✓	✓	
conflicts with other theories, including those that predict stasis in response to performance shortfalls.	✓			✓
focuses on a narrowly delineated outcome, the resolution of the focal problem, overlooking ancillary outputs.			✓	

## TABLES

**Table 1: Triggering Mechanisms of Problemistic Search:  
Key Topics, Arguments, and Selected Example Studies**

Key topics	Arguments in the literature	Selected example studies		
Aspiration as a threshold of problemistic search	Lower-than-aspiration performance stimulates organizational effort to remedy the problem.	Aranda, Arellano, & Davila (2017) Audia, Locke, & Smith (2000) Askin & Bothner (2016) Bolton (1993) Chen & Miller (2007) Chuang & Baum (2003)	Fredrickson (1985) Greve (1998) Greve (2008a) Kim & Rhee (2017) Kraatz (1998) Lucas, Knoben, & Meeus (2015) McDonald & Westphal (2003)	Miller & Chen (1994) Park (2007) Rudy & Johnson (2016) Schillebeeckx, Chaturvedi, George, & King (2016) Schimmer & Brauer (2012)
	Firm performance comparable to or higher than the aspiration leads to strategic inaction.	Audia, Locke, & Smith (2000) Greve (1998) Miller (1994)	Miller & Chen (1994)	
	Shifts of managerial attention influence the triggering of problemistic search.	Blettner, He, Hu, & Bettis (2015) Chen & Miller (2007) Carter (1971)	Greve (2008a) Li, Maggitti, Smith, Tesluk, & Katila (2013)	Ocasio (2011) Plambeck & Weber (2009) [I] Washburn & Bromiley (2012)
	Attention may shift to different reference performance levels regarding the same aspiration to moderate the triggering of problemistic search.	Audia & Greve (2006) Blettner, He, Hu, & Bettis (2015) Castellaneta & Zollo (2015) Desai (2008)	Greve (2010) Iyer & Miller (2008) Joseph & Gaba (2015) Joseph, Klingebiel, & Wilson (2016)	Lehman & Hahn (2012) Lehman, Hahn, Ramanujam, & Alge (2011) Miller & Chen (2004) Ref & Shapira (2017)
	Attention may shift from social to historical aspirations and vice versa to moderate the triggering of problemistic search.	Aranda, Arellano, & Davila (2017) Blettner, He, Hu, & Bettis (2015) Bromiley (1991)	Deephhouse & Wiseman (2000)	
	Attention may shift across different goals to moderate the triggering of problemistic search.	Bakker & Shepherd (2017) Ertug & Castellucci (2013) Ertug & Castellucci (2015) Gaba & Joseph (2013) Greve (2008a)	Sullivan (2010) Vissa, Greve, & Chen (2010)	
	Psychological factors (e.g., self-enhancement motives and attribution) can affect triggering of problemistic search.	Audia & Brion (2007) Audia, Brion, & Greve (2015) Baum, Rowley, Shipilov, & Chuang (2005)	Bromiley & Harris (2014) Desai (2015) Hayward & Shimizu (2006) Jordan & Audia (2012)	Joseph & Gaba (2015)
	Differences across subgroups, coalitions, and units in the firm can affect triggering of problemistic search.	Carter (1971) Desai (2016a) Gaba & Joseph (2013)		

Notes. [I]: papers on individual or team level search.

[Table continues on next page]

Key topics	Arguments in the literature	Selected example studies		
Dimensions of aspirations	Financial performance has been used as the main measure of aspirations.	Arrfelt, Wiseman, & Hult (2013) Audia & Greve (2006) Audia, Locke, & Smith (2000) Bolton (1993) Bromiley (1991) Bromiley (2009) Bromiley & Washburn (2011) Chen (2008)	Chen & Miller (2007) Deephouse & Wiseman (2000) Desai (2008) Fiegenbaum (1990) Gaba & Joseph (2013) Greve (2003a) Greve (2003b) Gubbi, Aulakh, & Ray (2015)	Harris & Bromiley (2007) Lant, Milliken, & Batra (1992) Mezias, Chen, & Murphy (2002) Miller & Bromiley (1990) Miller & Chen (2004) Washburn & Bromiley (2012) Wiseman & Bromiley (1996)
	Non-financial goals have been used as alternative measures of aspirations.	Aranda, Arellano, & Davila (2017) Bednar, Boivie, & Prince (2012) Benson, Saraph, & Schroeder (1991) Baum, Rowley, Shipilov, & Chuang (2005)	Crilly, Zollo, & Hansen (2012) Gaba & Bhattacharya (2012) Greve (1998) Greve (2008a) Joseph, Klingebiel, & Wilson (2016) Ketchen & Palmer (1999) Lehman & Hahn (2012)	Moliterno, Beck, Beckman, & Meyer (2014) Parker, Krause & Covin (2017) Sitkin, See, Miller, Lawless, & Carton (2011) Tyler & Caner (2016)
	History of past performance contributes to the formation of aspirations (historical aspirations).	Arrfelt, Wiseman, & Hult (2013) Audia & Greve (2006) Boyle & Shapira (2012) [I] Baum, Rowley, Shipilov, & Chuang (2005) Chen & Miller (2007) Greve (1998) Greve (2003a) Greve (2008a)	Greve (2011) Harris & Bromiley (2007) Hundley, Jacobson, & Park (1996) Iyer & Miller (2008) Kacperczyk, Beckman, & Moliterno (2015) Kuusela, Keil, & Maula (2017) Lant (1992)	Lant & Montgomery (1987) Lim, & McCann (2013) Mezias, Chen, & Murphy (2002) Mezias & Murphy (1998) Miller & Chen (2004) Ref & Shapira (2017) Tuggle, Sirmon, Reutzel, & Bierman (2010) Tyler & Caner (2016)
	Performance of other comparable firms contributes to the formation of aspirations (social aspirations).	Audia & Greve (2006) Bromiley & Washburn (2011) Barnett & McKendrick (2004) Baum, Rowley, Shipilov, & Chuang (2005)	Desai (2008) Greve (1995) Greve (1998) Harris & Bromiley (2007) Iyer & Miller (2008)	Ketchen & Palmer (1999) Labianca, Fairbank, Andrevski, & Parzen (2009) Lim & McCann (2013) Shipilov, Li, & Greve (2011)
	The effect of social aspirations depends on how reference groups are specified.	Audia, Brion, & Greve (2015) Baum & Dahlin (2007) Greve (1995) Greve (1998)	Kacperczyk, Beckman, & Moliterno (2015) Labianca, Fairbank, Andrevski, & Parzen (2009)	Moliterno, Beck, Beckman, & Meyer, (2014) Short & Palmer (2003)
	Historical aspirations and social aspirations may be combined to form a single overall aspiration level.	Greve (2003b) Mezias, Chen, & Murphy (2002)		
	Historical aspirations and social aspirations may be separate with distinct (even opposing) effects.	Baum & Dahlin (2007) Baum, Rowley, Shipilov, & Chuang (2005)	Greve (1998) Kim, Finkelstein, & Halebian (2015)	
	Firms may switch between historical aspirations and social aspirations depending on the level of performance.	Bromiley (1991) Deephouse & Wiseman (2000) Park (2007) Washburn & Bromiley (2012)	Wiseman & Bromiley (1996)	

Notes. [I]: papers on individual or team level search.

**Table 2: Summary of Empirical Evidence on the Triggering of Problemistic Search**

CONTINUOUS MEASURE SPECIFICATION				
Coefficient Test of Problemistic Search Triggering	Historical/Social Combined	Historical	Social	Total number of results
Support of theory, statistically significant coefficient	4	7	9	20
Mixed statistical support	0	2	6	8
No support (statistically non-significant)	1	1	3	5
Opposing (statistically significant in opposite direction)	0	2	1	3
Number of studies	1	5	10	

SPLINE SPECIFICATION: <u>Below</u> Aspiration				
Coefficient Test of Problemistic Search Triggering	Historical/Social Combined	Historical	Social	Total number of results
Support of theory, statistically significant coefficient	1	11	15	27
Mixed statistical support	1	3	2	6
No support (statistically non-significant)	2	3	4	9
Opposing (statistically significant in opposite direction)	1	6	9	16
Number of studies	3	9	13	

SPLINE SPECIFICATION: <u>Above</u> Aspiration				
Coefficient Test of Problemistic Search Triggering	Historical/Social Combined	Historical	Social	Total number of results
Support of theory, statistically non-significant coefficient	0	8	11	19
Support of theory, statistically significant coefficient	4	9	10	23
Mixed statistical support	0	0	3	3
Opposing (statistically significant in opposite direction)	0	5	6	11
Number of studies	4	22	30	

Note: The table summarizes the results of 53 studies that directly test the threshold function of aspirations in triggering problemistic search. The counts represent the number of studies that use the corresponding measure of aspirations. If a single study uses multiple measures (e.g., both a continuous measure and a spline measure), we include its results in multiple cells that correspond with the measurement specifications. Similarly, a study may report separate results for historical aspirations, social aspirations, and a combined measure. If a study ran multiple tests with a single measurement type and found mutually inconsistent results, we coded its results as "mixed". Thus, there are more results than studies. The column "total number of results" aggregates the number of similar findings across different types of aspirations whereas the row "number of studies" counts the number of studies using a specific measure for a type of aspiration. For the spline specification above the aspiration, both a non-significant coefficient and a statistically significant positive coefficient are treated as supporting the theory.



**Table 3: Solution Search and Its Characteristics:  
Key Topics, Arguments, and Selected Example Studies**

Key topics	Arguments in the literature	Selected example studies		
Locus of problemistic search	Organizational search is predominantly local.	Audia & Goncalo (2007) [I] Dowell & Swaminathan (2006) [G] Gavetti & Levinthal (2000) [G] Katila & Ahuja (2002) [G]	Levinthal (1997) [G] Levinthal & March (1993) [G] Madsen & Desai (2010) March (1991) [G] Mayer & Argyres (2004) [G]	Martin & Mitchell (1998) [G] Rosenkopf & Nerkar (2001) [G] Tyler & Caner (2016) Stuart & Podolny (1996) [G]
	Local search has distinct advantages.	Anand, Mulotte, & Ren (2016) Denrell & March (2001)	Helfat (1994) Knudsen & Levinthal (2007) [G, I]	Simon (1978b) [I] Taylor & Greve (2006)
	Local search has distinct disadvantages.	Fleming (2001) [G] Fleming & Sorenson (2004) [G]	Katila (2002) [G] Levinthal (1997) [G]	
	Organizational mechanisms exist that allow search that is less local.	Ahuja & Katila (2004) [G] Baumann & Siggelkow (2013) Beckman (2006) [G] Bhardwaj, Camillus, & Hounshell (2006) [I] Csaszar & Siggelkow (2010) [G] Ethiraj, Levinthal, & Roy (2008) Gavetti & Levinthal (2000) [G]	Gupta, Smith, & Shalley (2006) [G] Lavie, Stettner, & Tushman (2010) [G] Laursen (2012) Laursen & Salter (2006) [G] Raisch & Birkinshaw (2008) Rivkin (2000) [G]	Rivkin & Siggelkow (2003) [G] Rothaermel & Deeds, 2004 [G] Rosenkopf & Almeida (2003) [G] Schildt, Maula, & Keil, 2005 [G] Siggelkow (2002) [G] Siggelkow & Rivkin, 2005 [G] Wadhwa & Kotha (2006) [G]
	Problemistic search may be less exploitative than is assumed.	Barkema & Schijven (2008) Baum & Dahlin (2007) Ben-Oz & Greve (2015)	Beckman, Haunschild, & Phillips (2004) [G] Posen & Chen (2013)	
Online versus offline evaluation in problemistic search	Search may involve online evaluation, in which a potential solution must be implemented in order to assess its merits.	Argote & Miron-Spektor (2011) [G] Gavetti & Levinthal (2000) [G] Haleblian, Kim, & Rajagopalan (2006)	Khanna, Guler, & Nerkar (2016) Levitt & March (1988) [G] Winter, Cattani, & Dorsch (2007) [G]	
	Search results may be evaluated offline requiring higher cognitive abilities.	Csaszar & Levinthal (2016) [G] Fleming & Sorenson (2004) [G] Gavetti & Levinthal (2000) [G]	Martignoni, Menon, & Siggelkow (2016) [G] Winter, Cattani, & Dorsch (2007) [G]	
Intensity of problemistic search	Below-aspiration, the greater the distance between current performance and the aspiration level, the greater the resources invested in problemistic search.	Chen (2008) Chen & Miller (2007) Hundley, Jacobson, & Park (1996) Lim & McCann (2013) Vissa, Greve, & Chen (2010)		
	Institutionalized search processes can be present, functioning in parallel to problemistic search.	Antonelli (1989) Chen & Miller (2007) Gubbi, Aulakh, & Ray (2015) Vissa, Greve, & Chen (2010)		
	Availability of slack resources may lead to more search, though it may reduce problemistic search.	Bromiley (1991) Chen (2008) Greve (2003a) Greve (2003b) Greve (2003c)	Chen & Miller (2007) Singh (1986) Voss, Sirdeshmukh, & Voss (2008) [G]	
	Slack resources may suppress problemistic search among some potential solutions.	Barreto (2012) Fang, Kim, & Milliken (2014) Kuusela, Keil, & Maula (2017)		
	Empirical research typically assumes, at least implicitly, search is online	Audia & Greve (2006) Greve (1998) Harris & Bromiley (2007)	Iyer & Miller (2008)	
	Firms may shift attention away from the performance based aspiration to a survival goal under severe threat such as bankruptcy.	Audia & Greve (2006) Chen & Miller (2007) Desai (2008) Iyer & Miller (2008) March & Shapira (1992)	Mone, McKinley, & Barker (1998) Shimizu (2007)	

Notes. [I]: papers on individual or team level search. [G]: papers on general search not particularly problemistic search

**Table 4: Behavioral Consequences of Problemistic Search: Key Topics, Arguments, and Selected Example Studies**

Key topics	Arguments in the literature	Selected example studies		
Organizational change	Performance shortfalls relative to generic aspirations (e.g., ROA) lead to broad change in firms' strategic orientation.	Audia, Locke, & Smith (2000) Greve (2003b) Grinyer & McKiernan (1990) Kang & Shivdasani (1997)	Lant, Milliken, & Batra (1992) Miller & Chen (1994)	
	Performance shortfalls relative to a specific aspiration (e.g., new product development productivity) lead to a change narrowly matched to the aspiration.	Baum & Dahlin (2007) Baum, Rowley, Shipilov, & Chuang (2005) Boyle & Shapira (2012) Gaba & Bhattacharya (2012) Greve (1998)	Greve (2008a) Hoang & Ener (2015) Ketchen & Palmer (1999) Lehman, Hahn, Ramanujam, & Alge (2011) Rhee (2009)	
	Performance shortfalls relative to generic aspirations (e.g., ROA) lead to a narrowly defined change (e.g., factory expansion).	Arrfelt, Wiseman, & Hult (2013) Audia & Greve (2006) Bolton (1993) Bromiley (1991) Chen (2008) Chen & Miller (2007)	Iyer & Miller (2008) Kuusela, Keil, & Maula (2017) McDonald & Westphal (2003) Moliterno & Wiersema (2007) Greve (2003a) Harris & Bromiley (2007)	Park (2007) Ref & Shapira (2017) Souder & Bromiley (2012) Vissa, Greve, & Chen (2010)
Risk taking	Failure to meet aspirations induces decision makers to accept higher risks.	Boyle & Shapira (2012) Bromiley (1991) Desai (2016b) Fiegenbaum (1990) Fiegenbaum & Thomas (1988)	Gooding, Goel, & Wiseman (1996) Greve (2003a) Lant, Milliken, & Batra (1992) McNamara & Bromiley (1997) Maslach (2016)	Miller & Leiblein (1996) Wiseman & Bromiley (1996) Palmer & Wiseman (1999) Petkova, Wadhwa, Yao, & Jain (2014)
	Organizations may react to very high performance shortfalls with reduced risk taking.	Audia & Greve (2006) Klingebiel (2017) Miller & Bromiley (1990)		
	Contextual factors moderate the relation between a performance shortfall and risk-taking.	Audia & Greve (2006) Boyle & Shapira (2012) Chen, Katila, McDonald, & Eisenhardt (2010)	Ferrier, Fhionnlaioich, Smith, & Grimm (2002) Greve (2011) Hu, Blettner, & Bettis (2011) Kim & Rhee (2017)	Lim & McCann (2014) Madsen (2013) Miller & Bromiley (1990) Miller & Chen (2004)



**Table 5: Stopping Mechanisms of Problemistic Search:  
Key Topics, Arguments, and Selected Example Studies**

Key topics	Arguments in the literature	Selected example studies		
Performance improvement leads to stopping of problemistic search	Problemistic search improves subsequent performance.	Audia, Locke, & Smith (2000) Bromiley (1991) Desai (2016a)	Greve (2003a) Greve (2008a) Miller & Leiblein (1996)	Posen & Chen (2013) Wiseman & Bromiley (1996)
	Problemistic search does not necessarily improve performance.	Greve (1999) Greve (2003c) Oliva & Serman (2001)		
	Higher performing firms engage in less problemistic search.	Fiegenbaum (1990) Gaba & Bhattacharya (2012)	Greve (1998) Greve (2007)	Miller (1994) Park (2007)
Aspiration degradation leads to stopping of problemistic search	Repeated failure to reduce the performance shortfall may lead to aspiration degradation — as the aspiration adjusts towards current performance.	Greve (2002) Hambrick, Geletkanycz, & Fredrickson (1993) Lant (1992)	Mezias, Chen, & Murphy (2002)	
Attentional shifts lead to stopping of problemistic search	Managers' attention may shift between different reference points regarding the same aspiration.	Audia & Greve (2006) Blettner, He, Hu, & Bettis (2015) Chen & Miller (2007) Desai (2008) Greve (2010)	Iyer & Miller (2008) Joseph & Gaba (2015) Lehman & Hahn (2012) Lehman, Hahn, Ramanujam, & Alge (2011)	Miller & Chen (2004) Ref & Shapira (2017)
	Managers' attention may shift between different aspirations (historical versus social).	Bromiley (1991) Deephhouse & Wiseman (2000) Blettner, He, Hu, & Bettis (2015)		
	Managers' attention may shift between different goals.	Gaba & Joseph (2013) Greve (2008a)	Vissa, Greve, & Chen (2010)	